NUTRITIONAL STATUS AND INTELLIGENCE OF PRE-SCHOOL BENEFICIARIES OF ICDS AND NON-BENEFICIARIES OF THRISSUR DISTRICT

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THESIS

Submitted in partial fulfilment of the
requirement for the degree of

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(FOOD SCIENCE AND NUTRITION)

Faculty of Agriculture
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Department of Home Science
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1998

DECLARATION

I hereby declare that the thesis entitled '**Nutritional status and intelligence of preschool beneficiaries of ICDS and non-beneficiaries 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, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that the thesis entitled `**Nutritional status and intelligence of preschool beneficiaries of ICDS and non-beneficiaries of Thrissur district'** is a record of research work done independently by **Ms.Merly Mariam Mathen**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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We, the undersigned members of the Advisory Committee of **Ms.Merly Mariam Mathen**, a candidate for the degree of **Master of Science in Home Science** with major in **Food Science and Nutrition**, agree that the thesis entitled **'Nutritional status and intelligence of preschool beneficiaries of ICDS and non-beneficiaries in Thrissur district'** may be submitted by Ms.Merly Mariam Mathen in partial fulfilment of the requirement for the degree.

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Dedicated To...

... My Adorable Parents

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Introduction

INTRODUCTION

Children are the life's foundation on earth and they are the future potential of a nation. The development and prosperity of a nation depends on the physical, mental and social well-being of this most important asset. The chronic deprivation of these precious resources is much prevalent and directly costly occurence world wide. In developing countries this wastage is set in motion primarly by undernutrition, poor health and inadequate mental stimulation of children below six years (Mc Guire and Austin, 1987).

According to Kathuria (1994) pre-school children comprise 18 per cent of our total population and constitute the most vulunerable section of the population nutritionally. These years are characterised by growth and development that has an effect on the human beings entire life as such. Limitation of one or more factors critical for growth may have serious repurcussions on the realisation of full genetic potential - both physical and mental.

The majority of pre-school children belonging to the poor income groups in developing countries suffer from various degrees of growth retardation due to mental deprivation. Malnutrition is a major factor in the massive morbidity and mortality of children throughout the world. Throughout the 1980's and early 1990's more than 12 million children died before their fifth brithdays each year, mainly due to a combination of malnutrition and disease (Kent, 1994).

Mc Guire and Austin (1987) reported that undernutrition is a direct or contributing cause of more than half of early childhood deaths. Children who are

most at risk of undernutrition, morbidity, retarded mental development and mortality show one common attribute - poor growth in early years of life. These children become less productive adults and are more likely to perpetuate the poor growth syndrome in the next generation.

In recent years marked interest has risen whether chronic undernutrition during the pre-school years modifies behaviour and mental capacity. Children who have suffered from chronic undernutrition and/or inadequate stimulation in their early years tend to have lower IQ's and poorer performance in school (Mc Guire and Austin, 1987). It is shown that if severe deficiencies are experienced during the periods of intense development of the brain, they may result in permanent psychomotor development (Pelletier, 1993).

A child to have normal intelligence must be born in healthy social, educational and nutritional environment, because all these are pre-requisites for development of brain. Since, within six years of age 90 per cent of the brain development is completed, these factors must operate during these years and if delayed, developmental milestones will be hampered (Lahiri *et al.*, 1994). Earlier remedial action and an enduring enriched environment can go a long way in enabling the child to acquire cognitive, linguistic and other skills to get out of the poverty trap (Sinha and Durganand, 1994).

Due to interlocking problems of the grinding poverty of families, children grow in uncongenial environment characterised by non-availability of civic-amenities, health care and lack of access to cognitive stimulation, skills and knowledge. These remain as the major unmet needs of children in India. Several intervention programmes and services therefore, have emerged during the last few

decades, inorder to safeguard survival and development of disadvantaged children (NIPCCD, 1992).

The child has only one opportunity for growth and since the process of that growth is so subtle and susceptible, the protection given to them should not be just a priority but an absolute. In other words, the child should be able to depend on that commitment at all times and through all difficulties, rather than being at the mercy of shifting circumstances and competing priorities (Grant, 1992).

Thus keeping in view the constitutional provisions and the provisions of U.N. Declarations of Rights of the Child, Government of India adopted a National Policy for Children in 1974. The policy indicates adoption of several measures to ensure provisions of "adequate services to children, both before and after birth and through the period of growth, to ensure their full physical, mental and social development. These measures include implementation of programmes to provide comprehensive health services to all children, nutrition services to remove deficiencies in their diet, health care, nutrition and nutrition education of expectant and nursing mothers, non-formal education for pre-school children and many other programmes aimed at ensuring the physical, mental and social well-being of children.

In pursuance of the National Policy for Children, Integrated Child Development Services (ICDS) scheme was launched on 2nd October, 1975 in 33 experimental blocks. The beneficiaries are children below 6 years, pregnant and lactating women and other women in the age group of 15 to 44 years. The objectives of the scheme are: (I) to improve the nutritional and health status of children in the age group of 0-6 years; (ii) lay the foundation for proper

psychological, physical and social development of the child; (iii) reduce the incidence of mortality, morbidity, malnutrition and school drop out; (iv) achieve effective co-ordination of policy and implementation amongst the various departments to promote child development and (v) enhance the capability of the mother to look after the normal health and nutrition needs through proper nutrition and health education (Tandon, 1997).

Towards achieving these objectives, a package of services is rendered essentially through the Anganwadi workers (AWW) at the village centre called "Anganwadi". The ICDS package of services rendered to the beneficiaries include (i) supplementary nutrition, (ii) immunization, (iii) health check-up, (iv) referral services, (v) nutrition and health education for women and (vi) non-formal preschool education.

According to Ghosh (1997) ICDS now covers almost 4000 blocks out of 5329 blocks i.e., 75% of the country, and will cover the whole country during the Ninth Five Year Plan. It is the biggest child welfare programme in Asia and probably in the world.

The philosophy and approach of ICDS lies in the belief that the overall impact will be much greater if different services are delivered in an integrated manner, as the efficiency of a particular service depends upon the support it receives from related services (Ghosh, 1991 and Kapil *et al.*, 1996).

Supplementary feeding programme forms the important component of nutritional inputs in ICDS, the main objective being to provide nutritional support

to women during pregnancy and lactation and young children during 0 months to 6 years of life.

Various studies have been conducted in India to analyse the impact of ICDS on malnutrition and the effect of malnutrition on intelligence.

But there have been very rare attempts especially in Kerala to analyse the relationship between nutritional status and intelligence among ICDS beneficiaries.

Hence the present study was conducted:

1. To make a comparative analysis of nutritional status of ICDS and non ICDS pre-school beneficiaries belonging to farm families and
2. To assess the association, if any, between nutritional status and level of intelligence among preschool children.

Review of Literature

REVIEW OF LITERATURE

India's child population of 0-6 years is around 18 per cent of the total population and out of this 30.76 million comprise the children from the household living below the poverty line in rural areas. They are a weak and vulunerable group and are exposed to many health, environmental, social and economic hazards (Kapil and Nayar, 1996). The incidence of mortality, morbidity and malnutrition among children continues to be very high. Malnutrition, if it is severe and occurs early enough, may result in reduced mental development due to impairment of brain development during the period of rapid growth (Kadam *et al.*, 1984). It is therefore of paramount importance that the children of the nation are nurtured well and their interest adequately safe guarded. Thus various intervention programmes were implemented for the upliftment of children by national and international agencies and one among it is ICDS. A brief review of literature on the following sub-heads is presented as under:

1. profile of the child in India
2. malnutrition among preschoolers: causes and consequences
3. role of intervention programmes to combat malnutrition
4. impact of ICDS on malnutrition and
5. nutrition, brain development and intelligence

2.1 Profile of the child in India

In India 40 per cent of its population belonged to the group of 1-6 year old children and they represent the most critical part of our human resources. There

were about 127 million children in the age group 0-6 years constituting one-sixth of the population. It has been estimated that in 0-6 years age group there were 89.7 million in rural areas, 7.3 million in tribal areas and 24.0 million in urban areas in the year 1981 (NIPCCD, 1995).

The present scenario of health and nutrition of this crucial age group will largely determine the quality and calibre of our nation in 2000 AD and beyond (Gopalan, 1983). But the condition of these children are as appalling as exhibited by the under five mortality which is estimated to be at the rate of 154 per 1000 live births and the infant mortality around 101 per 1000 live births (UNICEF, 1996). Thus India has been included among the countries having `high under five mortality rates'.

Gopalan (1984) reported that in India 15.5 million young children, between the age from birth to 5 years die each year mainly as a result of malnutrition, diarrhoea and respiratory diseases. UNICEF (1988) reported that 33 per cent of children under five in India are suffering from mild/severe forms of malnutrition.

In India there are about 20 million children in organised labour work force, 30 million disabled children and more than 25 million street children. The number of those suffering from malnutrition and diseases is extremely high (NIPCCD, 1995).

A burgeoning population with associated increase in the child population, poverty, illiteracy and ignorance, poor state of villages and increasing ubran slums are important factors which lead to a poor quality of life for the majority of our

children. Whereas child survival has improved, as indicated by a decline in various indices of mortality, the necessary inputs towards various other needs of children have been grossly insufficient. Despite lip service and regular expressions of concern, children have remained a low priority. For example, universal primary education must be a fundamental priority of every society, yet in India the expenditure on primary education has falled from 56 per cent in the first plan to about 36 per cent in subsequent plans (Srivastava, 1996).

The health profile of the children of our country is reported to be due to improverished economic, social and enviornmental conditions existing within the country which impedes their physical and mental development (ICCW, 1984). Hence as reported by NIPCCD (1984), inorder to develop a significantly sound and economically feasible nutrition strategy, all developmental efforts needs to be focussed on children between the age group of 0-6 years.

Thus the preponderance of the child population in the country, with 37.4 per cent of the population below the poverty line, emphasizes the need for development programme to promote and enrich the well-being of children in the country.

2.2 Malnutrition among pre-schoolers: causes and consequences

Malnutrition is undoubtedly the biggest, public health problem in our country today. Among the most vulnerable group of population from the nutritional stand point are infants and young children (Gopalan *et al.*, 1986).

Bakshi (1977) remarked that, pre-school children are the most important component of child population, since this age is the most inadequately protected,

emotionally and immunologically, and hence prone to develop malnutrition and various vitamin deficiencies. Khanna and Krishnamurthy (1989) and Harris (1992) reported that this most vulnerable period required proper nourishment for normal growth and development. Lack of proper nourishment led to many disastrous consequences like stunted physical growth, generalised functional impairment disability, diminished productivity and increased chances for infections.

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

According to Ebrahim (1991) the infant mortality in many developing countries is high compared with western countries; the pre-school age mortality is higher still and in some cases it is as much as 40 times the rate in western countries. These high rates of morbidity and mortality are due to combined effects of malnutrition and infection.

Kapil and Nayar (1996) reported that the silent form of hunger and malnutrition continue with over 43.8% children suffering from moderate malnutrition and about 37.6 per cent from mild malnutrition. Therefore, while more children are surviving today, an overwhelmingly large number of them are destined to remain below their genetic potential.

According to Li (1993) malnutrition contributes directly and indirectly to about 1/2 of the deaths in young children. About 40 million pre-school children are acutely malnourished and more than three times suffer from chronic malnutrition.

According to 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.

Bhaskaran and Rao (1987) reported that about 1 to 2 per cent of preschool children belonging to poor communities of India suffer from severe forms of protein energy malnutrition.

Studies conducted in an ICDS Block at Rajasthan by Mandowara (1986) revealed that 10.10 per cent of children were having severe grades of protein energy malnutrition. It was also observed that maximum number of children (56.26 per cent) were malnourished under 2 years of age and of these comparatively higher percentage (55.21 per cent) were female children.

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.

Chandra and Thayar (1985) had conducted an initial survey of 3082 children in Tamil Nadu and found that only 5 per cent of the children were in severe degree of malnutrition. According to Ganasundaram and Santhanakrishnan (1986) less than 2.4 per cent of the preschool children surveyed at urban slums of Madras had III and IV grades of malnutrition compared with national figure of 8.5 per cent.

According to Jeffrey (1988), 85 per cent of the Indian children under 5 years are undernourished.

A considerable decline in the prevalence of malnutrition from 19.1 per cent in 1976 to 7.8 per cent in 1983 was reported by UNICEF (1987). Vasi (1988) had reported that `severe cases of malnutrition requiring hospital care constitute less than 5 per cent of the poor rural preschool population in countries of the third world, malnutrition was wide spread and mild to moderate forms of malnutrition in children was known to be prevalent among nearly 80 per cent of preschool child population in India and other developing countries.

Thomas (1989) reported that the prevalence of moderate malnutrition was 70 per cent and undernutrition 13 per cent among pre-school children belonging to agricultural labourers families of Thiruvananthapuram district. Beegum (1990), in her studies among pre-school children belonging to different socio-economic groups in Thiruvananthapuram urban areas revealed mild and moderate malnutrition was 46 and 34 per cent respectively.

UNICEF (1992) conducted studies on the prevalence of malnutrition among pre-school 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.

Shyna (1996) in her studies among pre-school children belonging to agricultural labourer families of Thrissur district, reported that majority of boys and girls were having normal growth and there was no incidence of severe grades of malnutrition among these children.

The result of a study conducted by Nyasha (1995) showed that nutritional status of a child under 5 years of age is determined by a variety of factors that are biological, social, cultural and economical in nature namely birth status, birth weight, diarrhoeal status, duration of breast feeding and residence.

The main cause of malnutrition is the quantitative and qualitative insufficiency of food intake. Malnutrition is self perpetuating: a child's nutritional status at any point in time depends on his or her past history, which may particularly acount for his or her present status (Pelletier, 1993).

According to Pelletier *et al.* (1993) 56 per cent of child deaths in developing countries could be attributed to malnutrition and its synergestic effects on infectious disease. This is about 10 times greater than conventional estimates that ignore the effect of underlying nutritional problems on case fatality rates. The analysis also revealed that 83 per cent of deaths occured in children with mild and moderate degrees of growth retardation and only 17 per cent of deaths occured in children with the type of extreme growth failure which generally defined severe malnutrition.

It is now recognised that the causes of malnutrition among preschoolers are multifactorial and complex and the problem in most instances concerns adequate intake to meet energy requirements and not a specific deficiency of protein (Mclaren and Meguid, 1988).

Jonsson (1995) reported that inadequate dietary intake and disease are the immediate causes or determinants of malnutrition. The inadequacy may include total energy, protein, vitamin or minerals.

Devadas (1979), Pelletier (1993), WHO (1993), Jonsonn (1995), Srilakshmi (1995) and Young (1995) have reported the determinants of malnutrition to be poverty, poor socio-economic status, illeteracy, poor environment hygeine, inadequate food intake, ignorance, false believes, tradition, poor living conditions, poor recreational facilities, faulty food habits and lack of knowledge on child care and child rearing practices.

According to Choudhry and Rao (1983) the prevalence of severe and mild forms of malnutrition are due to abnormal environmental and socio-economic status. They also reported that educational level of parents may also play a crucial role in reducing the incidence of malnutrition among toddlers.

Chatterjee (1984) opined that determinants of child malnutrition are maternal factors and nutritional status and occurence of infection in children.

Mahmud (1985) has revealed that seasonal fluctuation is an important determinant which may markedly affect the nutritional status of children. Visweswara Rao (1987) had suggested that socio-economic and literacy status of parents and significant seasonal variations in health and nutritional status, influenced the intake of foods and dietary habits of pre-school children.

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

Lack of good nutrition during the first years of life lead to poor health and high rate of mortality (Kumar *et al.*, 1990).

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

Immediate consequences of malnutrition, according to WHO (1990) are high morbidity and mortality and the long term consequences are chronic under-nutrition, retarded growth and mental development and stunted adult stature.

According to Devadas (1986) malnutrition has a very devastating spiral effect on the society and cripples a nations human resources. For any nation such a loss of human resources has social and economic consequences which no country could afford.

In a report published by FAO (1992), it has been stated that "malnutrition - a man-made disaster" is an avoidable tragedy with enormous social and economic costs in wasted human potential. It affects growth and reproduction and undermines health, learning and working capacity and overall quality of life and well being.

Inadequate dietary intake may increase the susceptability to and severity of infection; conversely many infectious diseases reduce dietary intake and nutrient utilization through loss of appetite and reduced absorption.

According to Ebrahim (1991), when the body's resistance is lowered by undernutrition, minor infections can easily become severe and unless prompt and effective medical care is available they take their toll. Besides malnutrition, the vitality of the child is also affected by chronic parasitic infections of all kinds.

According to Okoye (1992), when an individual is malnourished with respect to a nutrient or a group of nutrients the metabolic reactions involving those nutrients become deranged, leading to the disruption of homeostatic control and hormonal balance. In chronic cases, the derangements may lead to disease conditions.

Thus malnutrition was a causative factor for various deficiency diseases like marasumus, kwashiorkar, xerophthalmia, scurvy, rickets, beri-beri, pellagra and anaemia (Swaminathan, 1986, Beegum, 1991 and Srilakshmi, 1993).

According to Devadas (1978) and Arya (1979) defective psychological functioning, lack of concentration, school failure, poor intellectual performance and lowered adaptive functioning and decreased response to stimulation are certain characters found to be prevalent in the survivors of early malnutrition.

High infant mortality and morbidity rates, high incidence of malnutrition, nutrition related diseases, temporary or irreversible disability and low literacy rates are reported to be some of the gloomy prospects staring at 110 million children under six years of age in India (ICDS, 1995).

2.3 Role of Intervention programmes to combat malnutrition

"Health for all by 2000 AD" - a goal of the final decade of this century could be achieved only if the major health problems and their deeply underlying causes are resolutely tackled by appropriate strategies, mobilising all human and material resources (Jasdel, 1989).

Nutrition is a multi-sectoral issue and needs to be tackled at various levels. Nutrition affects various development as much as development affects nutrition. It is therefore, important to tackle the problem of nutrition both through direct nutrition intervention for specially vulunerable groups as well as through various developmental policy instruments which will create conditions for improvement of nutrition (Kapil and Nayar, 1996).

According to Grant (1995) one of the main aims of development must be to break into the insidisous `inner cycle' of malnutrition and disease leading to poor mental and physical growth; leading to poor performance at school and at work; leading to reduced adult capacity for earning on income; leading to poor and often large families which are vulnerable to malnutrition and disease that close the cycle and allow the current of poverty to flow from one generation to next. The place at which to make that break is before the child is born and during the early years of life. If the mental and physical growth of the child can be afforded special protection at this time, if families and communities and governments can prevent the worst aspects of poverty from affecting child's normal growth and development, if special measures are taken to give those vulnerable months and years something of protection which is given to children fortunate enough to be born into a higher socio-economic class, then a major contribution to the breaking of the cycle could be achieved.

Human infants are totally dependent and are at the mercy of the adult for many years after birth due to their slow growth and development. To achieve all-round optimal growth and development children must be provided with adequate nutrition against environmental hazards, provided a relaxed and positive stimulating environment at home and school (Kakar, 1996). The need for special

protection for the young growing minds and bodies of children under the age of five has been described as, a `protective plastic bubble' over the early years of life.

Growth pattern and energy needs during pre-school years are highly variable. Growth rate slows, activity levels are generally high and appetite varies greately, resulting in erratic food intake (Report of the joint working of the Canadian Pediatric Society and Health Canada, 1995).

It is extremely important for children to be allowed to develop all of their potential to the utmost during the first years of life, which are the formative period for their personality, intelligence and social behaviour. Nutritional rehabilitation should restore the child's multi-faceted potential for development within his or her surroundings, well beyond the purely nutritional aspects; this required an approach which is simultaneously clinical, psychological, socio-economic, cultural and educational (Pelletier, 1993).

Higher childhood mortality and morbidity could constitute a substantial drain on human resources of the country and may neutralise the benefits of the economic progress. There is an increasing need to correct these distortions by providing health care, education, sanitation and an infrastructure where every child finds an oppurtunity and encouragement to develop into a healthy and productive human being (Sarma *et al.*, 1990).

Thus if pre-school age mortality and morbidity are to tbe reduced, an effort will be necessary in several directions. Community development and organisations play an important role because a scattered community of rural homesteads and small villages or a divided community in squatter slums can be

organised into co-operative groups, through which the child and family can be reached (Ebrahim, 1991).

According to Pandey (1996) the specific benefits of nutrition programmes include: (1) a reduction in infant and child mortality, (2) an elimination of retardation due to protein-energy deficiency, and (3) improved learning behaviour and productivity resulting from improved physical development, alertness and reduced absenteeism due to illness. These benefits generally result from an improvement in protein and calorie intake as well as from reduction of nutritional imbalances such as in vitamins A and B and iron.

According to Tandon and Sahai (1984) village level management of severely malnourished children by local workers is an acceptable and effective approach. Experience showed that nutritional improvement is a function of many factor such as access to the variety of foods to supply the daily needs in calories, proteins and nutrients, freedom from infections and other diseases; and knowledge of different types of food and feeding practices for the changing needs of growth and maintenance of health.

The families should be helped to care for the young child through support for health care, nutrition, sheltor education and employment. Simultaneously the possibility of every child having an equal chance, at the start of life, of attaining his or her potential needs to be advanced through community based programmes of early childhood care (UNICEF, 1991).

Kumari *et al.* (1985) had found that a combined approach of food supplement and nutrition education would be preferable in any nutrition intervention programme to achieve optimal results.

Well organised supplementary feeding programmes along with other health inputs are expected to improve the health status of children (Ganasundaram and Santhanakrishnan, 1986).

In Tamil Nadu, and Gujarat school feeding is the principal intervention to the relative neglect of children under three years who are extremely vulnerable from malnutrtion. The productivity of feeding programmes could reach, a large proportion of whom is malnourished, if nutritional support is oriented to cover not all children, but children below the poverty line (Subbarao, 1989).

The study conducted by Lahiri *et al.* (1994) puts emphasis on the need of balanced diet and non-formal education for normal nutritional status of all children upto 6 years of life. They also opined that both cohort and intervention studies are required to follow up the children for their school performance as well as to identify specific factors for improving the developmental progress.

Hoorweg (1988) stated that growing awareness about the nutritional problems in developing countries resulted in many manifold nutrition interventions. It is of the opinion that assessing the impact of nutrition intervention is notoriously complicated because of the difficulty in distinguishing between the impact of the programme and the influence of other factors.

A rough estimate puts the number of working mothers of children below five years at around 14-15 million, mostly belonging to low income groups in the unorganised sector. The number of such children needing care, but not necessarily receiving it would be of the order of 32-33 million. Clearly, child care services can be made a focal point for improvements in health, nutrition, education, training economic sustenance, fertility control and participation of women - apart from the benefits occuring to the children themselves, a large number of whom would otherwise experience an unsupervised and impoverished childhood (UNICEF, 1991).

Lal *et al.* (1978) evaluated three intervention programmes and revealed that percentage of normal children were found to be highest in the area where special nutrition programmes, medical care and immunization facilities were available to the children and were minimum in areas where only one programme is existing.

Naidu and Rao (1979) opined that supplementary feeding had beneficial impact on growth of undernourished children.

Habicht and Yarbrough (1980) observed that most of the severely malnourished children gained significantly more benefit than the children who were malnourished to a lesser extent in a nutrition intervention programme.

According to Susan and Allene (1980) participants in the National School Lunch Programme had better overall diets than non-participants.

Rajendran (1980) opined that apart from the improvement of nutritional status, feeding programmes do contribute to the non-nutritional benefits such as social integration among children, community organization, channel to health and family planning and also income transfer to poverty groups.

Using data from Cali, Colombia early intervention project, Selowsky (1981) calculated positive rates of return from integrated nutrition/early education programmes ranging from 0.6 to 2.2 per cent of GNP (depending on the percapita income in the country).

Beaton (1982) reviewed the impact of 43 supplementary feeding programmes on nutritional status and indicated that supplementary feeding programmes had a major impact on the nutritional status of the individual participating children and that the worse was the initial nutritional status of the child, the greater was the improvement in anthrpometric indices.

Devadas (1982) revealed that nutrition intervention right from pregnancy through pre-school age can prevent growth retardation and malnutrition in children.

Corazon *et al.* (1983) assessed the impact of one year dietary intervention on the nutritional status and growth of Philippine pre-school children and found that experimental groups had significantly higher height, weight for age, weight for length and arm circumference for ages. According to Sundararajula *et al.* (1983) there had been a significant positive impact in terms of physical and anthropometric parameters in children who attended the Tamil Nadu Chief Minister's free meal programme.

Prenatal dietary supplementation is reported to improve birth weights and substantially reduce the incidence of low birth weight (Nutrition News, 1984).

Vyas (1986) opined that improvement in health status of the mothers and children could be achieved, if individuals, families and the communities participated actively in the low cost health care interventions, since such participation might result in some behavioural change.

A meta-analysis of six field studies was conducted by Pollit and Oh (1994) on the effects of supplementary feeding on mental and motor development among nutritionally at risk children in Columbia, Guatimala, Indonesia, Jamaica, Taiwan and in U.S.A. showed that high energy and protein supplementary feeding had a beneficial effect on motor development in young infants and on both motor and mental developments in older infants.

The Cali study (Columbia) involved the random assignment of 301 malnourished children to be exposed to a multifocal day care based intervention. After the experimental phase, children were followed up in elementary school and the secondary data analyses showed that children who were exposed at an earlier and for a longer period showed the highest degree of improvement in weight and linear growth during the preschool period (Perez and Pollit, 1995).

The result of a study conducted by Pollit *et al.* (1996) showed that before the initiation of the school breakfast programme, there was no inter group difference in the intake of energy, protein and iron. After the initiation of the programme these 3 nutritional variables was significantly greater in experimental than in the control subjects.

Study conducted by Kennedy *et al.* (1982) in United States had shown that prenatal supplementation can improve the outcome of pregnancy but an equal or greater number had failed to demonstrate a positive effect.

Rao *et al.* (1982) commented that large scale supplementary feeding programmes so far undertaken to ameliorate the malady of protein energy malnutrition were found to have limited impact on the nutritional status of beneficiaries and no effect on changing the feeding practices of the comments. Feachem (1983) was of the opinion that impact of supplementary feeding programme on nutritional status of the target groups as a whole, was found to be low or nonexistent.

From the humanitarian perspective, the need to alternate the suffering of growth-deprived children and to enable them to develop to their full potential are moral imperatives for any responsible government. The political benefits of improving childrens growth are potentially high. It provides a means of galvanising all the population into action around a single popular issue, visibly demonstrates governmental concern for people's welfare and derails attempts by political opponents to use malnutrition as a rallying cry (Mc Guire and Austin, 1987).

2.4 Impact of ICDS on malnutrition

Integrated Child Development Services (ICDS) is the most comprehensive scheme of the Government of India for early childhood care and development. It was launched on 2nd October, 1975 as an experimental programme in 30 blocks of rural and tribal population and 3 urban slums and aims to lay a solid foundation for the development of India's human resources by providing an

integrated package of early childhood services (Ghosh, 1991; NIPCCD, 1992; Srinivasan, 1992; Avsm *et al.*, 1995; Kapil *et al.*, 1995 and Tandon, 1997). ICDS has now completed 22 years and expanded its operation to 5102 projects and will cover the whole country during the Ninth Five Year Plan. It is perhaps the only country wide programme in the world functioning on a large scale, requiring multisectional operations and intersectoral linkages for its implementation (Ghosh, 1997).

ICDS is a unique programme, it encompasses the main components of human resource development, namely, health, nutrition and education. Under ICDS, a package of services, including supplementary nutrition, immunization, health check-up and referral services is provided to children below six years of age and expectant and nursing mothers. Non-formal pre-school education is imparted to children in the age group of 3-6 years and nutrition and health education to women (15-45 years) (NIPCCD, 1992).

The objectives of this scheme are improvement of nutritional and health status of children aged 0-6 years; laying the foundation for proper psychological, physical and social development of the children; reduction of the incidence of mortality, morbidity, malnutrition and school drop-outs; achieving effective coordination of policy and implementation among various departments to promote child development and enhancing the capability of the mother to look after the normal health and nutritional needs of the children through proper health and nutrition (Tandon and Kapil, 1991).

Ebrahim (1991) stated that ICDS in India is a good example of low cost intervention for promoting the health and development of the pre-school child in disadvantaged communities.

Results of the study conducted by Kapil *et al.* (1996) revealed that factors responsible for better nutritional status of the ICDS children are the availability of health care facilities, supplementary nutrition and other services of the ICDS.

According to the Government of India estimates, more than 150 lakh children below 6 years of age and 40 lakh women beneficiaries are covered under the ICDS scheme (ICDS, 1993-1994). According to Bansel and Chandarkar (1993) the programme reached many people who are normally excluded from such schemes.

Studies conducted by All India Institute of Medical Science (1982) revealed that by the implementation of the programme, a reduction in infant mortality to 88.2/1000 live births in early childhood was achieved.

According to Tandon (1984), the coordinated approach for the delivery of health, nutrition and education services to mothers and infants through Integrated Child Development Services model had helped in reducing the Infant Mortality Rate in India. He also had reported a reduction from 15 to 3 per cent in mortality due to severe malnutrition.

Based on the monitoring data collected by the Central Technical Committee (CTC), it was concluded that prevalence of malnutrition declined faster in ICDS than in non ICDS blocks and that the infant mortality rate was 20 per cent

lower in ICDS areas, although the level of socio-economic development was lower in the ICDS as compared to non ICDS areas (CTC, ICDS, 1988).

There have been considerable improvements in child survival during the last one decade in India and IMR has declined by more than 35 per cent in the country. The death rates for children between 1-4 years of age has also declined by about 10 per cent during the same period (Ghosh, 1991).

UNICEF (1991) stated that in aggregate terms for all ICDS projects in the country, the overall impact of the programme had been positive, in terms of nutritional status as well as IMR.

A review of research studies conducted by NIPCCD (1992) showed that ICDS had a positive impact on beneficiaries and has the potential of enhancing the child survival rate. Definite improvements had been reported on major indicators of health and nutrition like IMR, nutritional status, morbidity pattern, immunization coverage and utilization of health service.

According to Sunderlal (1980) with the advent of the ICDS, the prevalence of severe grades of malnutrition declined markedly.

Chandra (1982) in his evaluative study on ICDS in Calcutta had found that, the number of children with III degree of malnutrition decreased and there was a shift from II or III to I degree malnutrition or normal.

Economic analysis of the implementation of ICDS was done by Makinen (1983) and the study revealed that the project expected significant reduction in the incidences of malnutrition and child mortality.

As per Mahendale *et al.* (1985) and Vivek *et al.* (1990) ICDS had a definite impact on health and nutritional status of children.

A longitudinal study showed that severe undernutrition amongst the pre-school children declined from 20.5 to 6.5 per cent within 8 years where ICDS was started as pilot project in 1976. Corresponding decline for moderate malnutrition was 28.9 to 17.7 per cent (ICDS, 1986).

Survey of the children in 15, of the original Integrated Child Development Services project Blocks in India had shown that severe malnutrition had fallen from 21 to 5.4 per cent over 21 months (UNICEF, 1986).

Gupta and Srivastava (1989) and Thakar and Jyotsna (1990) had reported that nutritional status of the beneficiaries of the ICDS programme were relatively better than that of the non-beneficiaries due to the impact of the package of the services provided to them.

Bawaskar and Sathe (1989) had observed that nutritional status of children belonging to the urban ICDS block was better than that of rural ICDS block in Aurangabad.

Beegum (1990) found that the food consumption pattern of the ICDS beneficiary pre-school children was better when compared to the children of the

control group and their nutritional status was better and it is attributed to the influence of nutrition education component of the integrated child development services.

As per UNICEF (1991) low prevalence of severe malnutrition has been reported from Andhra Pradesh, Haryana, Karnataka, Kerala, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal. Also a review of studies on nutritional impact of ICDS showed a lower percentage of malnutrition among pre-school children in ICDS compared to non-ICDS areas, 23.7 per cent against 28.1 per cent in moderate and severe cases.

The nutritional status of children in ICDS areas was better than that of children in non-ICDS areas. The percentage of normal children was 35 in ICDS areas and 31 in non-ICDS areas. Non-ICDS areas also recorded three per cent more children in Grade III and IV malnutrition as compred to ICDS areas (NIPCCD, 1992).

According to Avsm *et al.* (1995) the children with normal nutrition in ICDS blocks constituted 50% of the surveyed population in 1976 in comparison to 75% observed in baseline data of 1990 survey. There was a highly significant decrease in severely malnourished children from 21% in 1976 to 70% in 1990. The benefit of the programme was evident in all sections of the society including scheduled castes, scheduled tribes, backward and minority communities.

Gupta *et al.* (1984) pointed out that weight for age of children of ICDS group was significantly higher than that of control group. Chaturvedi *et al.* (1987) observed that mean weight and height measurements of both male and female

children belonging to ICDS projects were higher than those of non-ICDS groups. Sunderlal and Goomer (1989) had pointed out that the mean birth weight of male infants was found to be higher than that of female infants by 50 g and the incidence was found to be high in economically weaker sections in a rural ICDS block.

Sarma *et al.* (1990) found that weight profiles of children between 1 to 3 years of age in ICDS areas were significantly better than their non-ICDS counterparts.

The studies carried out by NIPCCD during 1990-92 revealed that higher percentage of babies had low birth weight in non ICDS areas as compared to ICDS area. In tribal areas, the difference was double (ICDS - 43.4%, non-ICDS - 80%). They also found that the difference in average of children from ICDS and non-ICDS areas were negligible for children in both 0-3 years and 3-6 years age groups. In fact, prevalence of PEM became apparent due to average weights being lower than the prescribed norms (NIPCCD, 1992).

The percentage of normal nutritional status was maximum in rural projects (77.3 per cent) followed by urban projects (72.2 per cent) and tribal area (69.6 per cent). When compared with the baseline data, the improvement in severe Protein Energy Malnutrition (PEM) was almost 4 times in rural areas (20.3% - 5.9%) compared to 2 and 2.5 times for tribal and urbal project areas, respectively.

Results of the study conducted by Sarma *et al.* (1990) revealed that only 1.4 per cent of the children from ICDS area and 2.2 per cent from non-ICDS were suffering from frank forms of protein energy malnutrition.

Lower prevalence of diarrhoea, dysentry and diseases of the skin and eyes were reported among the pre-school beneficiaries in Uttar Pradesh (Chaturvedi *et al.*, 1987).

Patel and Udani (1982) evaluated and studied the impact of various services provided through ICDS and showed that this scheme has made tremendous impact on the health status of the most needy children from poorest socio-economic class.

A study conducted by Natarajan (1986) to analyse the nutritional status of children in the age group of 0-6 years in Madras Urban Project revealed that 50 per cent of the children in the total population who had been ICDS beneficiaries, were in the green group as per Indian Academy of Pediatric's nutritional grading.

ICDS (1987) revealed that ICDS had a positive impact on maternal and child health and helped to bring down the infant mortality rate.

Srivastava (1989) observed an improved eating behaviour among children attending the anganwadies.

According to Widge and Aijaz (1986) the main attraction for enrolment in anganwadi centres was found to be the provision of supplementary food. They also had pointed out that majority of the beneficiaries were benefitting through the supplements.

According to Ukkuru (1993) the respondents of the nutrition component of ICDS considered the food supplement as nutritious, adequate and relishable.

The study by NIPCCD (1992), pointed towards better school enrolment in ICDS areas compared to non-ICDS areas and the role played by pre-school education in retention at school.

The study conducted by Aneja and Chhikara (1995) in Hisar district, Haryana, ICDS respondents were found to have greater knowledge than non-beneficiaries regarding all aspects covered in the health and nutrition education component of the ICDS.

Ukkuru (1993) observed that attitudes of ICDS beneficiaries in favour to supplementary nutrition programme was very high followed by other component like pre-school education, immunisation, health check-up, health education and lastly referral services.

Various studies and surveys conducted by the planning commission, All India Institute of Medical Sciences, National Institute for Public Co-operation and Child Development, Home Science Colleges and many academicians revealed that ICDS had decreased malnutrition, anemia, other preventable diseases and infant and childhood mortality (Government of India, 1986).

2.5 Nutrition, brain development and intelligence

Intelligence is comprehensively defined as the aggregate of global capacity of an individual to act purposefully, to think rationally and to deal effectively with the environment (Prabhu and Raghuram, 1984).

Brain is accepted as the seat of intellect and the phenomenon of concurrent synoptogenesis across all areas in the cerebral cortex has been established. This phenomenon, peaking at 1-2 years and not decreasing substantially until 7 years of age, is necessary for co-ordination of many cortical functions for performance of a skilled task. Maternal environment provides nourishment, other biological needs, protection and certain oppurtunities for functional stimulation and thus influences development (Vazir, 1988 and Fischer and Kurt, 1987).

Morgane *et al* (1992) revealed that presence of malnutrition during neurogenesis and cell migration and differentiation will also cause permanent brain damage. They further suggested that the damage could result in relatively minor brain dysfunctions which would eventually lead to attention disorders and learning disabilities.

Marginal malnutrition not only affects childrens brain growth and mental function but adversely affected their emotional and behavioural quality of life and ability to function in society. Such behavioural changes would affect children's interactions with their environment leading to further developmental delays.

Malnourished children experience high rates of infections and have more frequent complications than do those who are well-nourished. The younger the child, the more apt he is to sustain permanent retardation in growth and in brain function. The earlier in life the malnutrition begins, the more lasting the effect on brain development and behaviour. Malnutrition may act on mental development through loss of learning time, interference during critical periods for learning and changes in motivation and personality (Kadam *et al.*, 1984).

Numerous studies have shown that severe undernutrition in early life delays brain development. The occurence of many biochemical alterations and clear retardation of mental development has been decreased during this period. Undernutrition early in life can decrease the ability to learn and this decreased ability to learn appears to be due to decreased number of brain cells resulting from early undernutrition (Kadam *et al.*, 1984). According to the author malnutrition had a definite impact on the intellgence of children, the degree of malnutrition being related to their intellectual functioning.

In Cali, Colombia investigation by Mc Kay *et al.* (1978) found significant difference in I.Q.'s of chidren who had been supplemented and stimulated since three or four years of age.

Studies conducted by Richardson (1980) and Galler *et al.* (1983) among Jamaican children and Barbados school children respectively revealed that in comparison to control children, malnourished children had lower I.Q. scores and lower academic achievement.

The results of the studies conducted by Kabra *et al.* (1980) showed that difference in performance of children having poor nutritional status and good nutritional status were statistically significant. According to the authors in the undernourished group, there was no case with normal IQ and 57 per cent had mental abnormality. With increasing severity of undernutrition there was a significant fall in the performance on intelligence scale.

In Mexico, Chavez and Martinez (1981) found significant difference in behaviour at school, but not in school-age I.Q, of chronically undernourished

compared to suplemented children. They also found that I.Q.'s of supplemented children dropped while attending school, while I.Q.'s of unsupplemented children stayed the same or improved.

In Bogota, Colombia, Weber *et al.* (1981) found significant effects of supplementation, stimulation and both together on intellegence test performance between 4 months and five and-a-half years.

Riccuiti (1982) observed that poor nutritional status led to impared learning and intellectual development with irreversible mental retardation. He also reported that children with malnutrition had reduced levels of intellectual functioning and school achievements.

Choudhary and Rao (1984) concluded, from their study among 4-5 years old pre-schoolers from Jaipur city, that mental function is associated with the growth status of children. I.Q.'s were lower in children with chronic-current severe or chronic forms of malnutrition than those who were either normal or with current moderate forms of malnutrition.

Mc Gregor (1984) revealed that children with severe malnutrition had a serious delay in the intellectual development in the acute stage or immediately following it.

According to Dobbing (1985) undernutrition affects brain growth, attention span and short term memory, but it also affects activity levels and general interactions with the environment. Thus promotion of somatic growth possible in

the period before the 2nd or even the 3rd birthday is the most we can do to assure brain growth.

Halpern and Myers (1985) found that in USA, comprehensive, health, nutrition and intellectual stimulation programmes were originally shown to have modest effects on I.Q. that disappeared after programme completion.

Mc Guire and Austin (1987) stated that chronic undernutrition, because of the duration of impairment of the childs interaction with his or her environment, seems to have more profound effects on mental development than on isolated case of severe acute malnutrition.

Puri *et al.* (1987) conducted a longitudinal study on the impact of nutritional supplementation on mental ability of pre-school children and reported that children provided with school luch were found to be superior in I.Q. than those who did not get school lunch and thus were malnourished.

Evidence of impairment of both physical and mental abilities were observed among children with physical growth retardation (NIPCO, 1988). It was concluded that mild and moderate degree of malnutrition could impair muscular efficiency and intellectual development of children.

In their study Agarwal *et al.* (1989) found that nutrition was the only factor weakly associated with the poor performance of children in various tasks. The effect of nutrition was more pronounced in conversation tasks indicating poor verbal reasoning and comprehension in malnourished children.

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.

Sharma and Sharma (1993) stated that the pre-school age is the most important growing period for academic achievements. They also stated that the analysis of food has helped in understanding that, quality of food taken by the individual decides the quality and size of the brain, in other words intelligence of the individual. Review of certain studies by the authors revealed that malnutrition reduces the number and size of brain cells together with its lipid, nucleic acid, enzymes and protein content and affect significantly the intelleigence and learning capacity of children.

Lahiri *et al.* (1994) studied the relation between IQ scoring and nutritional status of children in the age group of 3-6 years and significant association was observed between IQ level and nutritional status of the children.

Wachs (1995) stated that growth failure is a risk factor for poor cognitive performance. As Wach notes malnutrition is embedded in a host of other biological and psychosocial contextual risk factors.

According to James *et al.* (1996) in population with endemic childhood malnutrition early supplementary feeding prevents the malnutrition induced delay in the rate of mental development and stimulated rapid improvements in mental functions. Food supplementation given with mental stimulation after the peak time of accelarated postnatal brain growth markedly improves the mental function and

scholastic performance of undernourished children many years later. According to the authors there was a close link between the impact of food supplementation on height, growth and a spurt in brain development.

The results of the study conducted by Shyna (1996) concluded that there existed a strong influence (above 50%) between nutritional status and mental functions of pre-school children.

According to Grantham-Mc Gregor (1982) there found to be a well known association between shortness and impairment of mental development.

According to Choudry and Rao (1984) much of the variation in IQ was explained by the nutritional anthropometry.

A study conducted by NIN (1987) found that the best set of indicators related to mental formations were height, arm circumference, head and chest circumference and maternal nutrition.

A study conducted by Carmona *et al.* (1990) showed a correlation between IQ and present height.

Passmore and Eastwood (1986) had shown a beneficial effect of dietary supplements on mental functions among under-fed children.

According to Weber *et al.* (1981) energy, proteins, vitamins and minerals supplementation to infants had positive effect on the cognitive competence.

Beutron and Roberts (1990) experimented on children between 12-13 years of age with normal growth and without any clinical signs of nutrient deficiency and found that additional vitamins and minerals supplemented had a positive effect on mental ability.

Results of the study conducted by Schoenthaler *et al.* (1991) showed that inadquate vitamin-mineral intake can adversely affect behaviour in children.

Madan (1988) opined that nutritional deficiency in a marasmic child limits the interaction of the child with her environment and impairs intellectual development with severe deficits. Thus limitation of growth results in stunted adult who had reduced physical working ability and thus become responsible for human and economic waste.

Severe protein energy malnutrition was found to have adverse effect on brain growth, cell number and cell morphology which retarded physical and intellectual development (Udani and Emery, 1982).

Barret and Frank (1990) showed that the provision of a bread based supplement to Guatimalan children aged 6-8 years with mild to moderate protein energy malnutrition resulted in improved mental test scores.

According to Harrell (1990) and Riggs *et al.* (1996) thiamine supplementation given to children between 9 to 19 years of age improved their mental ability test scores.

In the Philippines Popkin and Lim-Ybanez (1982) examined the relationship between nutritional status and performance on achievement test among Filipino children aged 12 to 14 and found that anaemia affected language score.

In Indonesia, Pollit (1984) found that iron deficiency anaemia negatively effects attention span and school performance.

Recent reviews have covered the growing research area relating iron nutrition to cognition and behaviour. These studies demonstrated a consistency in the observation that iron-deficient children have alterations in attention span, lower intelligence scores, and some degree of perceptional disturbance (Lozoff and Brittenham, 1986, Pollit and Metallinos, 1990, Connor, 1992, Beard *et al.*, 1993, Pollit, 1993 and Sheard, 1994).

Verghese (1995) in her study on iron deficiency and behaviour pattern in pre-school children in Trivandrum districts revealed that iron deficiency obtained lower scores (below 60%) when compared to normal children.

Azizi *et al.* (1993) in their study indicated the occurrence of physical and psychomotor disturbance in apparently normal school children from areas of Iodine deficiency. Alterations in psychomotor development may occur in children with normal physical growth due to iodine deficiency.

Tiwari *et al.* (1996) studied the effect of prolonged iodine deficiency on learning and motivation. The results suggested that neural impairment as well as poor sociopsychologic stimulation, resulted in learning disability and lowered achievement motivation.

Ashworth (1986) revealed that poor nutritional status retarded both physical and intellectual development and non-nutritional factors like sociocultural background of the family, income and literacy level of family members affected the nutritional status of children which in turn affected the overall development of the children.

Agarwal (1987) revealed that there was a relationship between malnutrition, home environment and intellectual development.

Singh and Sidhu (1987) revealed that there was a significant difference in I.Q. of well nourished and malnourished school children.

Sood (1987) reported that brain of a healthy child weighed 25 per cent the weight of an adult man and grew at a faster rate completely within 5 years. According to the author any adverse environmental, social, economic or nutritional conditions might have irreversible consequence on child's brain growth and hence on intelligence.

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

Sandhya (1989) reported that nutritional as well as non-nutritional factors influenced intellectual development of children. The statistical analysis of the data regarding nutritional status and intelligence revealed that even though the children

were having normal height and weight for age, their performance in intelligence tests were poor since these children had low haemoglobin levels and diets were deficient in iron and vitamin A.

Herens *et al.* (1992) in their study among 4-5 year old children concluded that long standing mild to moderate malnutrition may not affect mental development in pre-school children, if they grows in a stimulating social environment.

Results of the study conducted by Vazir (1990) and ICMR (1992) suggested that childhood malnutrition as such may not influence adult intelligence. Since adult nutrition was found to be highly correlated with childhood nutritional status, it is reasonable to conclude that malnutrition is one of the important factors in the total adverse environment influencing intelligence but its `singular' contribution in a direct one-to-one casual relationship with intellegence has yet to be ascertained.

In a study carried out by Ukkuru (1993) assessment of cognition among respondents denoted significantly superior cognition among the experiemtnal group compared to the control group.

Materials and Methods

MATERIALS AND METHODS

The study on the nutritional status and intelligence of pre-school beneficiaries of Integrated Child Development Services (ICDS) and non-beneficiaries of Thrissur district was designed to

1) Analyse the nutritional status of ICDS pre-school beneficiaries and non-beneficiaries (4-6 years age group) and to
2) Assess the association, if any between nutritional status and level of intelligence.

This chapter deals with methods and procedures followed in the various phases of research as follows.

3.1 Locality of the study

The area under the jurisdiction of Thrissur district was selected for the study. Out of the 10 ICDS blocks of Thrissur district, 8 ICDS blocks (which have been implemented for a long period) - viz. Chavakkad, Anthikkad, Chalakudy, Mala, Pazhayanoor, Mullassery, Thalikulam and Irinjalakuda were selected as the

experimental group. Two Anganwadi centres (AWC) were selected from rural Anganwadi centres of each selected ICDS block. The non-beneficiary group (The Control group) were selected from seven non ICDS blocks of Thrissur district - viz. Ollukkara, Kodakara, Cherpu, Kodungalloor, Mathilakom, Puzhakkal and Chovvannoor. Two panchayats were selected at random from each of these seven blocks and one ward was selected at random from each selected panchayat. One balwadi centre (BWC) was selected from each ward. A total of eight ICDS blocks comprising of 16 anganwadi centres and seven non ICDS blocks comprising of 14 panchayats and 14 wards, where there was maximum agricultural activities as per the 1991 census, constituted the study sample from Thrissur district.

3.2 Plan of action (Research plan)

The study envisaged the following plan of action.

1. Verification of records to collect details regarding the ICDS and non-ICDS blocks and location of Anganwadi centres (AWC) and Balawadi centres (BWC) from the Directorate of Social Welfare and Collectrate.
2. A pilot survey to locate the Anganwadi centres and Balawadi centres of Thrissur district.
3. A base line survey to monitor the socio-economic and personal characteristics of the families.
4. A dietary survey to assess the food consumption and dietary pattern of the families.
5. A base line survey to collect details regarding the index child from mothers and class teachers.

6. A base line survey to monitor the ICDS programme implemented in the study area.
7. Assessment of health and nutritional status of children through -
   a) Anthropometric measurements such as height, weight, head circumference, chest circumference and mid upper arm circumference.
   b) A one day food weighment survey, to determine the actual food and nutrient intake of selected pre- school children.
   c) Biochemical estimation of blood for haemoglobin in selected pre-school children.
   d) Clinical examination to identify the deficiency symptoms in selected pre-school children.
8. Assessment of intelligence of pre-school children of both the control and the experimental groups.
9. Analysis of the data using suitable statistical techniques.

3.3 Selection of sample

With the prior permission and assistance of the officials of the Directorate of Social Welfare and Thrissur Collectorate, 16 anganwadi centres (AWC) from 8 ICDS blocks (the experimental group) and 14 balwadi centres (BWC) from 7 non ICDS blocks (the control group) were selected.

AWC and BWC were selected after the initial visit of rapport establishment with the AWC and BWC functionaries, based on the participation level of the preschool children.

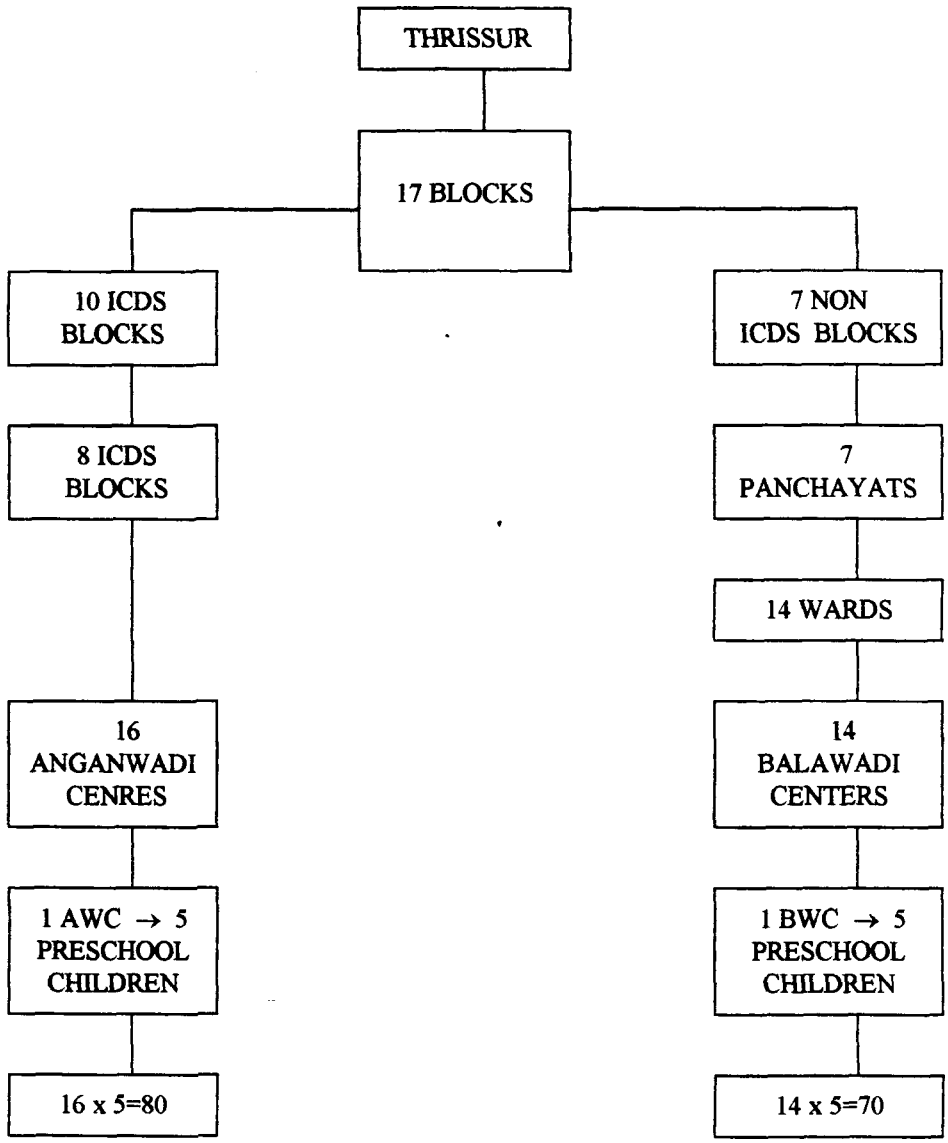


Fig. 1. Selection of the study sample

A sample of five families were selected at random from each selected AWC and BWC. From each AWC and BWC, five preschoolers (4-5 age group) were selected from those belonging to the farm families.

Thus a total of 80 ICDS beneficiaries (experimental group) from 16 AWC belonging to 8 ICDS blocks and 70 non ICDS beneficiaries (control group) from 14 BWC belonging to 7 non ICDS blocks, thus making the total sample 150, were selected from Thrissur District for the study.

For conducting detailed study one child each was selected from 8 ICDS and 7 non ICDS blocks. Thus a total of 15 preschool children (8 ICDS beneficiaries and 7 non ICDS beneficiaries) and their families were selected as the subsample for conducting the detailed study.

3.4 Methods selected for the study

Interview is the most commonly used method of survey. In this study also data were collected using pre-tested interview schedules through house visits. The advantages of the interview method is that it consists of face to face verbal interchange and a large number of families can be covered within a specific time. Care was also taken to continue the dialogue until the information obtained were sufficient and the accuracy of the answers were checked by supplementary questions (Plate 1).

3.4.1 Socio-economic status and personal characteristics of the families were assessed, with the help of a schedule which was pretested before field application,

Plate 1. Interview with the mother

by interviewing the respondents viz., the mothers of pre-school children. The schedule used is given in Appendix I.

3.4.2 The food consumption and dietary pattern of the families were assessed with the help of a pretested schedule and is presented in Appendix II.

3.4.3 Informations on health and behavioural problems of children were collected from mothers with the help of an interview schedule (Appendix III).

3.4.4 General performance of the children in schools such as behavioural problems, intellectual development, social behaviour patterns etc. were assessed and recorded by the class teachers, regarding using a structured schedule (Appendix IV).

3.4.5 An appraisal of the ICDS programme implemented in the study area was done with the help of suitable schedule (Appendix V).

3.4.6 Direct parameters of nutritional status were assessed using anthropometric indices, monitoring actual food intake, conducting clinical examination and estimating the haemoglobin of blood.

(a) Anthropometric survey

Anthropometric method is considered as a suitable technique to monitor health and nutritional status of pre-school children participating in health programmes (Kim and Pollit, 1987). In the anthropometric survey the height, weight, head circumference, chest circumference and mid upper arm circumference

Plate 2. Measuring the height of the child

Plate 3. Measuring the weight of the child


കേന്ദ്രം (C.P.W.P)
This Building is constructed by Archana Mahila
Samajam Nattissseri with financial assistance
from C.D. Block Elukkara and CIRE.

Plate 4. Measuring the head circumference of the child

Plate 5. Measuring the chest circumference of the child


കേന്ദ്രം (C.P.W.P)
This building is constructed by Archana Mahila
Samajam Nettoor with finan
from C.D.Blo

Plate 6. Measuring the mid upper arm circumference of the child

Plate 7. Weighing the raw foods


5 Kg.

Plate 8. Weighing the cooked foods

Plate 9. Weighing the amount of cooked foods consumed by the pre-school child

of the pre-school children were recorded since, Sharma and Kalia (1990) stated that nutritional anthropometry is one of the most important and simple method of assessment of growth especially in rapidly growing children. The measurements were taken as suggested by Jeliffee (1966) and is presented in Appendix VI (Plate 2, 3, 4, 5 and 6).

(b) Food weighment survey

Mary (1985) had stated that actual food consumption within the family through one day weighment could be better mentioned in microsamples. For assessment of nutritional status of both experimental and control group of preschool children a one day weighment survey was conducted in a subsample (15 children). The investigator weighed the raw foods included in the meal for a day, and the weights of each cooked preparation was also recorded (Plate 7 and 8). The amount of each food item consumed by the child was also weighed, so also the plate waste, to get the exact amounts of foods consumed (Plate 9).

Any other extra foods consumed by both the group were also taken into account. All these weighments were carried out using standard measuring cups and spoons and also by means of a food weighing balance. The amount of food items consumed by the child was then converted to its raw equivalents. The nutrients available from the food consumed was computed using food composition tables (Gopalan *et al.*, 1995). The schedule used to assess the actual food intake is given in Appendix VII.

(c) Biochemical investigation

Biochemical estimation give more definite information on nutritional status than anthropometric and food intake measurements. They are therefore

Plate 10. Drawing blood sample for the estimation of haemoglobin

Plate 11. Clinical examination by the physician

employed in diagnosing and in confirming diagnosis of nutritional deficiencies (Okoye, 1992).

In the present study, under the biochemical estimation of haemoglobin levels of 15 children belonging to the subsample were determined by Cyanmethaemoglobin method (NIN, 1983). The procedure is given in Appendix VIII (Plate 10).

(d) Clinical examination

Clinical examination is the most important part of the nutritional assessment, since it provided direct information of signs and symptoms of dietary deficiencies (Swaminathan, 1986). Clinical examination was conducted in the subsample of the children with the help of a qualified physician (Plate 11). Standardised schedule is given in Appendix IX.

3.4.7 Intelligence of children

Age for age, bright children show more intelligence than those who are less bright. They have more ideas in handling social conflict situations and are able to formulate more solutions to these conflicts (Albert and Alliot, 1991).

Intelligence is comprehensively defined as the aggregate of global capacity of an individual to act purposefully to think rationally and to deal effectively with the environment (Huslock, 1995).

Level of intelligence of both experimental and control groups of preschool children were assessed by Mathew's Test of Mental Abilities. This test is

Plate 12. Presenting the demonstration problem

Plate 13. Carrying out the intelligence test

claimed to meet the criteria of simplicity, precision, objectivity, reliability, validity and economy which are the cardinal features of a good test. This test enabled the investigator to get clearly discernible picture about the child's brain's capacity to solve the problems and behavioural characteristics in both the experimental and control groups. The details are given in Appendix X.

This test consisted of a set of 12 problems and has a plastic base plate 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 first demonstrated the demonstration problem to the child (Plate 12) and then the child was asked to solve the problem by itself. This was repeated till the child could do the problem itself. Then the first set of the problem were given to the child and the time taken to solve the problem was recorded using a stop watch. This was followed by the remaining 11 problems (Plate 13). If the child does not succeed in three minutes, he was stopped and the problem was marked failure and each failure was recorded as 180 seconds. This was continued till the child fails in two consecutive problems. The scores obtained by each child was used for calculating the IQ of each child. IQ was then interpreted as described by Mathew (1973). The investigator conducted this test on both experimental and control group through AWC/BWC visits.

3.5 Statistical analysis

Various statistical techniques used in this study to analyse the results are percentage analysis, analysis of variance and multiple regression.

Results

RESULTS

The results of the study entitled "Nutritional status and intelligence of preschool beneficiaries of ICDS and nonbeneficiaries of Thrissur district are presented in this chapter under the following headlines.

1) Socio economic background and personal characteristics of the families of preschool children.
2) Food consumption and dietary pattern of the families of preschool children.
3) Details regarding the index child.
4) Assessment of the children by the class teacher.
5) An appraisal of the ICDS programme implemented in the study area.
6) Nutritional status of preschool children which entails details of
   a) Actual food and nutrient intake of selected preschool children.
   b) Anthropometric measurements of preschool children.
   c) Biochemical profile of selected preschool children.
   d) Clinical assessment of selected preschool children.
7) Intelligence of the preschool children and
8) Association between nutritional status and IQ.

4.1 Socio economic background and personal characteristics of preschool children

Socio economic background and personal characteristics of the families were assessed in terms of religion, caste, type and size of the family, educational and employment status, monthly income, possession of land, cultivation of food crops, domestication of animals, monthly expenditure pattern, housing conditions, living facilities, exposure to mass media and social participation.

4.1.1 Religion and caste

Table 1 furnishes information on the religion and caste of the study groups.

Table 1. Distribution of families based on religion and caste

Religion	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Hindu	57	81.43	43	53.75
Forward	15	26.32	8	20.93
OBC	34	59.65	28	65.12
SC	8	14.03	6	13.95
Christian	8	11.43	20	25.00
Muslim	5	7.14	17	21.23
Total	70	100.00	80	100.00

Among the 70 families surveyed in the control group majority of the families were Hindus (81.43%). Eleven point four three per cent of the families were christians and muslims formed 7.14 per cent of the group. In the experimental group, among 80 families, 53.75 per cent were Hindus. Christians constituted 25 per cent while the remaining 21.25 per cent belonged to the Muslim community.

On further enquiry regarding the caste of the 150 respondents surveyed, it was observed that majority of the respondents in both the control and experimental groups (59.65% and 65.12% respectively) were from backward communities and scheduled castes comprised of 14.03 per cent from the control group and 13.95 per cent from the experimental group.

4.1.2 Type of family and family size

Distribution of the families according to type and size of the family is presented in Table 2.

Table 2. Details of type of family and family size

Religion	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Type of family				
Joint	30	42.86	45	56.25
Nuclear	40	57.14	35	43.75
Total	70	100.00	80	100.00
Family size				
No. of adults				
1	0		0	
2	37	52.86	35	43.75
3	7	10.00	12	15.00
4	9	12.86	17	21.25
5 and above	17	24.28	16	20.00
Total	70	100.00	80	100.00
No. of children				
1	11	15.71	11	13.75
2	36	51.43	40	50.00
3	16	22.86	20	25.00
4	6	8.57	8	10.00
5 and above	1	1.43	1	1.25
Total	70	100.00	80	100.00
Family size				
Total members				
3-5	40	57.14	44	55.00
6-8	24	34.29	26	32.50
9-11	5	7.14	8	10.00
Above 11	1	1.43	2	2.50
Total	70	100.00	80	100.00

Of the 150 families surveyed a joint existence was exhibited by 42.86 per cent of the control group and 56.25 per cent of the experimental group, while it was seen that nuclear existence was reverse with 57.14 per cent in the control group and 43.75 per cent in the experimental group.

Regarding the family size majority of the families in both the groups had 3-5 members. On detailed analysis it was found that in both the groups, most of the families were made up of 2adults and 2 dependent children.

4.1.3 Educational status of parents

Table 3 pictures the educational status of both the parents separately.

Table 3. Educational status of parents

Educational status	Control group				Experimental group			
	Father		Mother		Father		Mother	
	No.	%	No.	%	No.	%	No.	%
Illiterate	1	1.43	1	1.43	2	2.50	4	5.00
L.P.S.	9	12.86	6	8.57	3	3.75	2	2.50
U.P.S.	13	18.57	11	15.71	10	12.50	11	13.75
High School	44	62.86	38	54.29	63	78.76	54	67.50
College	3	4.28	14	20.00	2	2.50	9	11.25
Total	70	100.00	70	100.00	80	100.00	80	100.00

As depicted in Table 3, 62.86 per cent of the families of control group and 78.75 per cent of experimental group had high school educated fathers as compared to 54.29 per cent and 67.5 per cent of mothers in the control and the experimental group respectively. College education was found to be more among

mothers in both the groups (20% in the control group and 11.25% in the experimental group) as compared to fathers. Illiteracy level was found to be very low in both the group.

4.1.4 Occupational status of parents

Details regarding the occupational status of parents are given in Table 4a and 4b.

Table 4a. Occupational status of fathers

Occupation status	Control group		Experimental group	
	No.	%	No.	%
Agriculture	11	15.71	21	26.26
Agricultural labourers	52	74.29	50	62.50
Private job	6	8.57	6	7.50
Govt. job	1	1.43	3	3.75
Total	70	100.00	80	100.00

Table 4b. Occupational status of mothers

Occupation status	Control group		Experimental group	
	No.	%	No.	%
House wife	62	88.57	68	85.00
Agriculture	0	0	5	6.25
Agricultural labourers	1	1.43	1	1.25
Public sector	7	10.00	6	7.50
Total	70	100.00	80	100.00

As indicated in Table 4a and 4b majority of the fathers in both the groups were found to be agricultural labourers (74.29% and 62.5% in the control and experimental group respectively). Majorities of the mothers in both the groups were found to be housewives (88.57% in control group and 85% in experimental group). It was also observed that 6.25 per cent of mother in the experimental group alone were engaged in agriculture as compared to the control group.

4.1.5 Age of the mothers

Distribution of mothers by age is given in Table 5.

Table 5. Distribution of mothers by age

Age group (in years)	Control group		Experimental group	
	No.	%	No.	%
20-25	11	15.71	17	21.25
26-30	36	51.43	30	37.50
31-35	16	22.86	24	30.00
36-40	7	10.00	9	11.25

Majority of the mothers in both the groups were in the age group of 26-30 years, while 22.86 and 30 per cent of mothers in the experimental and the control group belonged to the age group of 31-35 years.

4.1.6 Availability of land

Table 6 depicts the availability of land.

Table 6. Possession of land

Area (in cents)	Control group		Experimental group	
	No.	%	No.	%
0-20	51	72.86	49	61.25
21-40	12	17.14	17	21.25
41-60	3	4.29	6	7.50
Above 60	4	5.71	8	10.00

An assessment concerning the possession of land indicated that majority of the families owned 0-20 cents of land (72.86% of control group and 61.25% of experimental group). Twenty eight point seven five per cent and 21.43 per cent in the control and experimental group respectively possessed 21-60 cents of land. Only a limited number of families owned more than 60 cents.

4.1.7 Cultivation of food crops

Table 7 gives a clear picture of the details regarding the cultivation of food crops.

Table 7. Details regarding the cultivation of food crops

Crop cultivation	Control group		Experimental group	
	No.	%	No.	%
Paddy	5	7.14	11	13.75
Paddy and coconut	9	12.85	5	6.25
Paddy and banana	1	1.43	1	1.25
Paddy, coconut and arecanut	3	4.29	4	5.00
Coconut	45	64.29	50	62.50
Coconut and arecanut	4	5.71	6	7.50
Pepper	2	2.86	3	3.75
Vegetables	1	1.43	0	0
Total	70	100.00	80	100.00

From the Table, it was clear that all the families in both the groups cultivated one or the other crop and majority of the families in both the groups cultivated coconut in their land (64.29 and 62.5% in the experimental and the control group respectively). Paddy was found to be the major crop for around 26 per cent of the families in both the groups.

4.1.8 Possession of livestock and availability of animal produce from livestock

Details regarding possession of livestock and avilability of animal produce from livestock are presented in Table 8.

Table 8. Details regarding the possession of livestock and availability of animal produce from livestock

Variable	Category	Control group		Experimental group	
		No.	%	No.	%
Possession of livestock	Yes	17	24.29	31	38.75
	No	53	75.71	49	61.25
Total		70	100.00	80	100.00
Availability of animal produce from livestock	Milk	6	8.57	8	10.00
	Egg	10	14.29	18	22.50
	Milk & egg	1	1.43	5	6.25
	None	53	75.71	49	61.25
Total		70	100.00	80	100.00

As indicated in Table 8, 24.29 per cent (control group) and 38.75 per cent (experimental group) were in possession of live stock. It was further observed that the milk, egg etc. got through the domestication of animals had been fully utilised by both the groups.

4.1.9 Income distribution of the families

The details regarding monthly income of the families are shown in Table 9.

Table 9. Income distribution of the families

Total monthly income (Rs.)	Control group		Experimental group	
	No.	%	No.	%
< 1000	1	1.43	1	1.25
1001-2500	55	78.57	63	78.75
2501-4000	13	18.57	15	18.75
4001-5000	1	1.43	1	1.25
Total	70	100.00	80	100.00

As depicted in Table 9, around 78 per cent of the families in both the groups had monthly income ranging from Rs.1001-2500. This group comprised mainly of agricultural labourer. In most of the families in both the groups, where parents were engaged in agriculture or where both the parents were employed, the monthly income ranged between Rs.2501-4500. Only 1.43 per cent (control group) and 1.25 per cent (experimental group) had income in the range of Rs.4001-5000, which came mainly from parents who had permanent jobs in government and public sectors.

4.1.10 Monthly expenditure pattern

Monthly expenditure pattern of the families for various items was ascertained and are presented in Table 10.

Table 10. Monthly expenditure pattern of the families

Percentage of income spent	Food		Clothing		Rent		Transport		Education		Health	
	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
No expenditure	-	-	-	-	65 (92.86)	72 (90.00)	1 (1.43)	0 (0.0)	-	-	1 (1.43)	0 (0.0)
1-10	-	-	70 (100)	80 (100)	2 (2.86)	3 (3.75)	68 (97.14)	79 (98.75)	70 (100)	80 (100)	67 (95.71)	72 (90.00)
11-20	-	-	-	-	3 (4.25)	5 (6.25)	1	1	-	-	2 (2.28)	8 (10.00)
21.30	-	-	-	-	-	-	-	-	-	-	-	-
31-40	1 (1.43)	2 (2.50)	-	-	-	-	-	-	-	-	-	-
41-50	2 (2.86)	15 (18.75)	-	-	-	-	-	-	-	-	-	-
51-60	60 (37.51)	61 (76.25)	-	-	-	-	-	-	-	-	-	-
61-70	6 (8.57)	2 (2.50)	-	-	-	-	-	-	-	-	-	-
Above 70	1 (1.43)	0 (0.00)	-	-	-	-	-	-	-	-	-	-
Total	70	80	70	80	70	80	70	80	70	80	70	80

Contd.

Table 10. Continued

Percentage of income spent	Savings		Own expenses		Repayment of loan		Kuries		Others		Entertainment	
	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
No expenditure	3 (4.29)	13 (16.25)	48 (68.75)	67 (83.75)	44 (62.86)	70 (87.50)	4 (5.71)	14 (17.50)	6 (8.57)	1 (1.25)	32 (45.71)	69 (86.25)
1-10	60 (85.71)	67 (83.75)	22 (31.43)	13 (16.25)	25 (35.71)	10 (12.50)	64 (91.43)	66 (82.50)	57 (81.43)	65 (81.25)	38 (54.29)	11 (13.75)
11-20	7 (10.00)	0 (0.00)	-	-	-	-	2 (2.86)	0	7 (10.00)	14 (17.50)	-	-
21-30	-	-	-	-	-	-	-	-	-	-	-	-
31-40	-	-	-	-	-	-	-	-	-	-	-	-
41-50	-	-	-	-	-	-	-	-	-	-	-	-
51-60	-	-	-	-	-	-	-	-	-	-	-	-
61-70	-	-	-	-	-	-	-	-	-	-	-	-
Above 70	-	-	-	-	-	-	-	-	-	-	-	-
Total	70	80	70	80	70	80	70	80	70	80	70	80

Numbers in parentheses are percentage

As evidenced from Table 10, a major share of the income was found to be spent on food items by both the groups. Around 87.51 per cent (control group) and 76.25 per cent of families (experimental group) spend 51-60 per cent of their income for food. Eight point five seven per cent (control group) and 2.5 per cent (experimental group) spend 61-70 per cent of the total income while 4.29 per cent (control group) and 21.25 per cent families (experimental group) spent only 31-50 per cent of their income on food. Almost all the families spent less than 10 per cent of their income on clothing, education, health, transport, entertainment and for personal expenses. It was seen that 7.14 per cent of families (control group) and 3.75 per cent of families (experimental group) spent only 1-20 per cent of their income on house rent.

It was found that 1-20 per cent of the monthly income was utilised for the repayment of loans by 37.14 per cent (control group) and 12.5 per cent of the families (experimental group). Majority of the families (85.71 and 83.75% in the control and the experimental groups respectively) saved upto 10 per cent of their family income, while 10 per cent (control group) saved 11-20 per cent of their monthly income. Ninety one point four three per cent (control group) and 82.5 per cent of the families (experimental group) utilised 0-10 per cent of their monthly income for crediting in *kuries*, while 2.86 per cent of the families in the control group credited 11-20 per cent of their monthly income in *kuries*.

4.1.11 Living conditions

Details of housing conditions of the families are presented in Table 11.

Table 11. Details of housing conditions (n=150)

Facilities	Control group		Experimental group	
	No.	%	No.	%
1	2	3	4	5
I. Type of house				
a) Own	65	92.86	72	90.00
Rented	5	7.14	8	10.00
b) No. of rooms				
One	1	1.43	1	1.25
Two	16	22.86	16	20.00
3-5	38	54.29	55	68.75
> 6	15	21.42	8	10.00
c) Type of roof				
Thatched	17	24.29	26	32.50
Tiled	41	58.57	36	45.00
Terraced	12	17.14	18	22.50
d) Structure of house				
Mud built	16	22.86	14	17.50
Brick built	54	77.14	66	82.50
II. Other characteristics				
a) Separate kitchen				
Yes	64	91.43	76	95.00
No	6	8.57	4	5.00
b) Source of drinking water				
Own well	48	68.57	49	61.25
Public tap	13	18.57	23	28.75
Public well	9	12.86	8	10.00
c) Lavatory facilities				
Present	53	75.71	63	78.75
Not present	17	24.29	17	21.25

Table 11. Continued

1	2	3	4	5
d) Drainage facilities				
Yes	4	8.57	76	95.00
No	66	91.43	4	5.00
e) Electricity facilities				
Yes	48	68.57	54	67.5
No	22	31.43	26	32.5
f) Transport facilities				
None	36	51.43	49	61.25
Bicycle	32	45.71	25	31.25
Scooter	0	0	4	5.00
Motor bike	2	2.86	1	1.25
Tempo lorry	0	0	1	1.25

As reported in Table 11, majority of the families (92.86% of control group and 90% of experimental group) had their own house. More than 50 per cent of the families surveyed had 3-5 rooms (54.29% of control group and 68.75% of the experimental group). House with 2 rooms were found in 22.86 and 20 per cent of the families in the control and experimental groups respectively. Twenty one point four two per cent of the families in the control group and 10 per cent in the experimental group had more than 6 rooms.

Majority of the families had their roofs tiled (58.57 and 45 per cent of the families in the control and experimental group respectively). Twenty four point two nine per cent (control group) and 32.5 per cent of the families (experimental group) had their roof thatched. Concrete roofing was observed in 17.14 per cent (control group) and 22.5 per cent of the families (experimental group). Majority of the houses of both the groups were built of brick (77.14 and 82.5 per cent of families in the control and experimental group respectively) while 22. 86 per cent (control

group) and 17.5 per cent of the families (experimental group) had their houses built of mud.

Other characteristics like separate kitchen, drinking water and lavatory facilities, drainage and electricity facilities and transport facilities of the families were studied.

The results showed that more than 90 per cent of the families in both the groups had separate kitchen (91.43% control group and 95% experimental group). Sixty eight point five seven per cent(control group) and 61.25 per cent of the families (experimental group) had their own well. Eighteen point five seven and 12.86 per cent of the families in the control group and 28.75 and 10 per cent of the families in the experimental groups utilised public taps and public wells respectively.

It was observed that 75.71 per cent (control group) and 78.75 per cent of the families (experimental group) had their own lavatory facilities. Majority of houses in the control group do not have proper drainage facilities (91.43%) while 95 per cent of the families in the experimental group had proper drainage facilities. Electricity facilities were available to 68.57 per cent (control group) and 67.5 per cent of the families (experimental group). Forty eight point five seven per cent (control group) and 38.75 per cent of the families (experimental group) possessed their own vehicle, while 51.43 and 61.25 per cent of the families in the control and the experimental group respectively did not own a vehicle.

4.1.12 Exposure to mass media

Exposure of the families to various mass media were analysed and the results are presented in Table 12.

Table 12. Distribution of families according to exposure to mass media

Type of media	Control group		Experimental group	
	No.	%	No.	%
T.V.	2	2.86	3	3.75
Radio	6	8.57	10	12.50
Newspaper	4	5.71	6	7.50
T.V. and Radio	1	1.43	4	5.00
T.V., Radio and newspaper	16	22.86	6	7.50
Radio and newspaper	35	50.00	40	50.00
Radio and magazine	6	8.57	11	13.75
Total	70	100.00	80	100.00

As furnished in Table 12, all the families in both the groups were exposed to one or the other mass media and 50 per cent in both groups had radio and newspapers in their house.

4.1.13 Social participation of mothers

Details regarding the social participation of mothers are furnished in Table 13.

Table 13. Social participation of mother

Social participation	Control group		Experimental group	
	No.	%	No.	%
Yes	67	95.21	76	95.00
No	3	4.29	4	5.00
Total	70	100.00	80	100.00

As revealed in the table majority of mothers in both the groups participated in social organisations such as mahila samajam, co-operative society, rural youth clubs etc.

4.2 Food consumption and dietary pattern of the families

Food consumption and dietary pattern of the families surveyed were assessed to provide an insight into the food habits, food expenditure, frequency of use of different foods, cooking methods followed, foods given during special conditions and diseased conditions.

4.2.1 Dietary habits of the families

Table 14 furnishes information on the food habits of the families.

Table 14. Food habits of the families

Food habits	Control group		Experimental group	
	No.	%	No.	%
Vegetarian	4	5.71	2	2.50
Non-vegetarian	66	94.29	78	97.50

From the above table, it is observed that majority of the families studied consumed non-vegetarian diet.

4.2.2 Food Expenditure Pattern

Table 15 reveals the details regarding monthlty expenditure of the families on different food items.

Table 15. Details regarding expenditure on food items

Food items	Nil				Upto 10%				11-20%				21-30%				31-40%			
	CG		EG		CG		EG		CG		EG		CG		EG		CG		EG	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cereals	11	15.71	12	15.00	22	31.43	25	31.25	29	41.43	41	51.25	6	8.57	2	2.5	2	2.86	0	-
Pulses	0	0	0	0	67	95.71	79	98.75	3	4.29	1	1.25	-	-	-	-	-	-	-	-
Green leafy vegetables	23	32.86	68	85.00	47	67.14	12	15.00	-	-	-	-	-	-	-	-	-	-	-	-
Roots and tubers	2	2.86	16	20.00	68	97.14	64	80.00	-	-	-	-	-	-	-	-	-	-	-	-
Other vegetables	0	0	1	1.25	55	78.57	64	80.00	13	18.57	15	18.75	2	2.86	0	-	-	-	-	-
Fruits	12	17.14	5	6.25	43	61.43	67	83.75	14	20.00	8	10.00	1	1.43	0	-	-	-	-	-
Milk and milk products	14	20.00	24	30.00	30	42.86	26	32.50	24	34.29	29	36.25	2	2.86	1	-	-	-	-	-
Meat	12	17.14	3	3.75	58	82.86	75	93.75	0	0	2	2.50	-	-	-	-	-	-	-	-
Fish	5	7.14	3	3.75	40.	57.14	65	81.25	24	34.29	12	15.0	1	1.43	0	-	-	-	-	-
Egg	24	34.29	42	52.50	46	65.71	38	57.50	-	-	-	-	-	-	-	-	-	-	-	-
Fat and oils	36	51.43	42	52.5	34	48.57	38	47.50	-	-	-	-	-	-	-	-	-	-	-	-
Nuts and oilseeds	29	41.43	35	43.75	41	58.57	45	56.25	-	-	-	-	-	-	-	-	-	-	-	-
Spices and condiments	0	0	1	1.25	70	100.00	79	98.75	-	-	-	-	-	-	-	-	-	-	-	-
Sugar and jaggery	2	2.86	0	0	68	97.14	80	100.00	-	-	-	-	-	-	-	-	-	-	-	-

It was found that 15.71 and 15 per cent of the families of the control and experimental groups respectively did not spent any money for the purchase of cereals. Majority of the families ie. 41.43 and 51.25 per cent of the families of the control and experimental group respectively spent 11-20 per cent of their income for the purchase of cereals. Ninety five point seven one per cent of the control group and 98.75 per cent of the experimental group spent up to 10 per cent of their monthly income for purchasing pulses.

Over 32 per cent of the control group and 85 per cent of the experimental group did not spend any money for the purchase of green leafy vegetables, while 67.14 and 15 per cent of the control and experimental group respectively spent up to 10 per cent for the purchase of green leafy vegetables. Majority of the families (78.57% in the control group and 80% in the experimental group) spent up to 10 per cent of their income for the purchase of other vegetables. Same trend was seen in the case of roots and tubers, fruits, milk and milk products, meat, fish, egg, fats and oils, nuts and oil seeds, spices and condiments, and sugar and jaggery, even though certain families spent nothing for the purchase of these food materials.

4.2.3 Frequency use of food items

Percentage distribution of families based on the frequency of use of food items is presented in Table 16.

As revealed in Table 16, all the families in both the control and the experimental groups included cereals in their daily diet. About 68.57 per cent (control group) and 42.5 per cent of the families (experimental group) consumed pulses daily. While 10 and 14.28 per cent of the families in the control group and

Table 16. Percentage of distribution of families based on the frequency of use of food items

Food items	Daily		Weekly								Monthly		Occassional		Never	
	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
Cereals	100.00	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pulses	68.57	42.50	0	2.50	10.00	21.25	14.28	30.00	7.14	3.75	-	-	-	-	-	-
Green leafy veget.	35.71	6.25	10.00	6.25	20.00	6.25	2.86	1.25	1.43	0	-	-	-	-	31.43	80.00
Roots and tubers	5.71	8.75	58.57	48.75	8.57	6.25	0	1.25	-	-	21.43	13.75	-	-	5.71	21.25
Other vegetables	78.57	65.00	1.43	5.00	7.14	13.75	7.14	8.75	5.71	6.25	-	-	-	-	0	1.25
Fruits	47.14	36.25	20.00	52.50	11.43	3.75	2.86	1.25	1.43	0	0	1.25	0	1.25	17.14	5.00
Milk & milk pdts.	85.71	86.25	-	-	-	-	-	-	-	-	-	-	-	-	14.28	13.75
Meat	2.86	1.25	32.86	43.75	0	5.00	-	-	-	-	47.14	46.25	-	-	17.14	21.25
Fish	68.57	70.00	7.14	8.75	2.86	10.00	7.14	5.00	1.43	0	5.71	2.50	-	-	7.14	3.75
Egg	58.57	53.75	5.71	7.50	7.14	5.00	7.14	5.00	2.86	3.75	0	3.75	1.43	0	17.14	21.25
Fats and oils	100.00	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuts and oilseeds	100.00	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spices and condiments	100.00	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sugar and jaggery	100.00	100.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-

21.28 and 30 per cent in the experimental group included pulses in their diet twice and thrice in a week respectively.

Regarding the consumption of green leafy vegetables it was found that 31.43 per cent (control group) and 80 per cent of the families (experimental group) never included this item in their diet. On further analysis it was observed that 35.71 per cent (control group) and 6.25 per cent (experimental group) consumed green leafy vegetables daily. Consumption pattern with regard to the vegetables indicated that 78.57 per cent of the experimental group and 65 per cent of the control group used vegetables daily.

With regard to roots and tubers, 58.57 per cent (control group) and 48.75 per cent of the families (experimental group) included this only once in a week and 21.43 and 13.75 per cent of the families in the control and experimental groups respectively consumed it once in a month. Another 5.71 per cent in the control group and 21.25 per cent in the experimental group never included this item in their meals.

Regarding the frequency of use of fruits in the daily meal pattern, it was found that 47.14 per cent (control group) and 36.25 per cent (experimental group) included it daily, while 20 per cent (control group) and 52.5 per cent (experimental group) used fruits weekly once, 17.4 per cent of the children in the control group never included fruits in their diets as against 5 per cent of the families in the experimental group.

With regard to the consumption of milk among the 150 families surveyed it was found that both the groups (86%) included it daily. While the rest were not in the habit of including milk in their daily dietaries.

On analysing the inclusion of meat, it was observed that 47.14 per cent of the families in the control group included meat monthly once, as against 46.25 per cent in the experimental group. It was also found that 32.86 and 43.75 per cent of the families in the control and the experimental groups respectively consumed meat weekly once and 17.14 and 21.25 per cent of the families in the experimental and the control groups respectively were non users of meat. Around 70 per cent of the families in both the groups were found to consume fish daily in the diet.

With regard to the inclusion of egg in the daily diet, 58.57 per cent of the families (control group) and 53.75 per cent of the families (experimental group) were found to consume egg daily. It was found that 17.14 and 21.25 per cent of the families in the control and the experimental groups respectively were not in the habit of using egg.

Daily consumption of foods such as fats and oils, sugar and jaggery, spices and condiments and nuts and oil seeds was observed in all the families of both groups.

The above data were analysed further to get precise information with regard to the frequency of use of various foods by experimental and control groups. The food use frequency was measured in a 7 point scale using the formula suggested by Reaburn *et al.* (1979), which is given in Appendix XI and is presented in Table 17.

Table 17. Frequency score (%) on different food items

Food items	Score	
	Control group	Experimental group
Cereals	100.00	100.00
Pulses	90.60	80.36
Green leafy vegetable	54.70	13.39
Roots and tubers	41.83	38.04
Other vegetables	93.26	86.61
Fruts	65.51	62.32
Milk and milk products	85.71	86.25
Meat	30.40	36.07
Fish	81.22	83.75
Egg	72.85	67.68
Fats and oils	100.00	100.00
Nuts and oil seeds	100.00	100.00
Spices and condiments	100.00	100.00
Sugar and jaggery	100.00	100.00

Table 17 reveals that respondent of both the experimental and control groups scored maximum for the food groups such as cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oilseeds, spices and condiments and sugar and jaggery. This was followed by green leafy vegetables, fruits and egg by the control group as against fruits and eggs in the experimental group. While roots and tubers and meat scored lowest in the control group, it was green leafy vegetables, roots and tubers and meat in the experimental group with a value of 13.39, 38.04 and 36.07 respectively.

Based on the percentage frequency scores obtained for different food items, the foods were classified into three groups viz. most frequently used (% score - above 75%), medium frequently used (% score - 50-75%) and less frequently scored (% score - below 50).

Table 18. Classification of various food items by percentage score of use

Frequency of use	Food items	
	Control group	Experimental group
Most frequently used (score: above 75%)	Cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oil seeds, spices and condiments, sugar and jaggery	Cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oil seeds, spices and condiments, sugar and jaggery
Medium frequently used (score: 50-75%)	Green leafy vegetables, fruits, egg	Fruits, egg
Less frequently used (score: below 50%)	Roots and tubers, meat	Green leafy vegetables, roots and tubers, meat

Table 18 depicts the frequency of use of different foods among the experimental and the control groups on the basis of percentage score. Foods most frequently used by the respondents of both groups were cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oil seeds, spices and condiments and sugar and jaggery. Medium frequently used foods by the control group were green leafy vegetables, fruits and egg as against fruits and egg in the experimental group. Least frequently used foods among the control group were roots and tubers and meat and in the experimental group, the foods were green leafy vegetable, roots and tubers and meat.

4.2.4 Cooking methods

Table 19 gives the details regarding the various cooking methods.

Table 19. Percentage distribution of families based on the cooking materials followed by the family

Cooking methods	Cereals		Pulses		Green leafy vegetables		Roots and tubers		Other vegetables		Meat		Fish		Egg		Milk & milk products	
	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
Boiling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64 (91.43)	70 (87.50)
Boiling & absorpiton	1 (1.43)	0 (0.0)	69 (98.57)	80 (100)	46 (65.71)	14 (17.50)	0 (0.0)	14 (17.50)	66 (94.29)	76 (95.00)	4 (5.71)	59 (73.75)	-	-	-	-	-	-
Boiling & steaming	69 (98.54)	80 (100)	1 (1.43)	0 (0.00)	1 (1.43)	0 (0.0)	69 (98.57)	50 (62.50)	2 (2.85)	0 (0.00)	-	-	-	-	-	-	-	-
Steaming	-	-	-	-	2 (1.43)	2 (2.50)	-	-	2 (2.86)	3 (3.75)	16 (22.86)	0 (0.0)	-	-	1 (1.43)	0	-	-
Frying	-	-	-	-	-	-	-	-	-	-	11 (15.71)	9 (11.25)	48 (68.57)	30 (37.50)	55 (78.57)	63 (78.75)	-	-
Shallow frying	-	-	-	-	-	-	-	-	-	-	2 (2.86)	0	0	1 (1.25)	-	-	-	-
Curry	-	-	-	-	-	-	-	-	-	-	25 (35.71)	9 (11.25)	16 (22.86)	46 (57.50)	0	2 (2.50)	-	-
Do not use	-	-	-	-	22 (31.43)	64 (80.0)	1 (1.43)	16 (20.00)	0 (0.0)	1 (1.25)	12 (17.14)	3 (3.75)	6 (8.5)	3 (3.75)	14 (20.00)	15 (18.75)	6 (8.57)	10 (12.5)

Numbers in parenthesis are percentage

Among the various cooking methods accepted boiling was found to be predominant. Cereals and roots and tubers were boiled in excess water and strained. Boiling and absorption method was followed in cooking pulses, GLV and other vegetables. Majority of the families followed frying method for fish and egg. Boiling and absorption method was followed in preparing meat by majority of the families in the experimental group (73.75%) while majority of the control group made curry (35.71) and also followed steaming method (22.86).

4.2.5 Special foods

Regarding foods given during special conditions, all the families gave special foods like ragi, banana powder and bulgar wheat for the infants. Pregnant women of the experimental group were given milk and fruits with their daily diet. No special food was given during preschool adolescence and lactation.

During diseased conditions, all the families avoided solid foods and used to give mainly rice gruel.

4.3 Details regarding the index child

The preschool child in the age group of 4-6 years was considered as the index child and details regarding the index child are presented in the following tables.

4.3.1 Gender distribution of index children

Table 20 gives the details regarding the gender distribution of index children.

Table 20. Gender distribution of index children

Gender	Control group		Experimental group	
	No.	%	No.	%
Male	35	50	40	50
Female	35	50	40	50
Total	70	100	80	100

Gender wise distribution of children revealed that equal number of male and female children constituted the study sample.

4.3.2 Birth order of index children

Birth order of index children is presented in Table 21.

Table 21. Birth order of index children

Birth order	Control group		Experimental group	
	No.	%	No.	%
I	36	51.43	40	50.00
II	23	32.86	33	41.25
III	11	15.71	7	8.75
Total	70	100.00	80	100.00

Around 50 per cent of the preschool children of both the control and the experimental groups belonged to the first birth order, 32.86 and 41.25 per cent of the children of the control and the experimental group respectively were of 2nd

birth order and 15.71 and 8.75 per cent of children of control and experimental groups respectively belonged to the third birth order.

4.3.3 Birth weight of the index children

Birth weight of the index children were recorded and is presented in Table 22.

Table 22. Birth weight of index children

Birth weight (in kgs)	Control group		Experimental group	
	No.	%	No.	%
Below 2.5	21	30.00	16	20.00
2.5-3.5	48	68.57	59	73.75
Above 3.5	1	1.43	5	6.25
Total	70	100.00	80	100.00

The results showed that majority of the children of both the groups (68.57 per cent in the control group and 73.75 per cent in the experimental group) had birth weights ranging from 2.5 kilograms to 3.5 kilograms. The birth weight of 1.43 per cent from the control group and 6.25 per cent from the experimental group was found to be above 3.5 kgs, while 30 per cent of the control group and 20 per cent of the experimental group belonged to low birth weight category.

The mortality rate of the children were enquired and it was found that no death was reported from both the control and the experimental group.

4.3.4 Immunisation status

Table 23 furnishes the details regarding the immunisation of the preschool children.

Table 23. Immunisation status of pre-school children

Immunisation status	Control group		Experimental group	
	No.	%	No.	%
Complete	56	80.00	77	96.25
Partially complete	13	18.57	2	2.50
Not taken	1	1.43	1	1.25

As depicted in Table 23, 80 per cent of the children of the control group and 96.25 per cent of the children of the experimental group followed complete immunisation pattern, whereas 18.57 and 2.5 per cent of children of the control and the experimental group were only partially immunised. 1.43 per cent of the children of the control group and 1.25 per cent of the children of the experimental group had not taken any of the immunization.

The relationship between the immunisation status and the educational level of the mothers and fathers were analysed separately and is presented in Table 24 and 25.

Table 24. Immunisation status and education level of mothers

Educational level	Complete				Partially complete				Not taken			
	CG		EG		CG		EG		CG		EG	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	0	0	4	5.00	0	0	0	0	1	1.43	0	0
L.P.S	3	4.29	2	2.50	3	4.29	0	0	0	0	0	0
U.P.S	7	10.00	10	12.50	4	5.71	1	1.25	0	0	0	0
High School	33	47.14	52	65.00	5	7.14	1	1.25	0	0	1	1.25
College	13	18.57	9	11.25	1	1.43	0	0	0	0	0	0

Table 25. Immunisation status and education level of fathers

Educational level	Complete				Partially complete				Not taken			
	CG		EG		CG		EG		CG		EG	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	0	0	2	2.5	0	0	0	0	1	0	0	0
L.P.S	7	10.00	2	2.5	2	2.85	0	0	0	0	1	1.25
U.P.S	9	12.86	9	11.25	4	5.71	1	1.25	0	0	0	0
High School	39	55.71	62	77.50	5	7.14	1	1.25	0	0	0	0
College	1	1.43	2	2.50	2	2.86	0	0	0	0	0	0

Analysis of the immunisation and mothers' educational status showed that for mothers who were educated up to high school, majority of the children in both groups (47.14 and 65% of children in the control and experimental group respectively) were completely immunised. Same trend was observed in the case of fathers also. For fathers who were educated up to high school, 55.71 per cent children (control group) and 77.5 per cent children (experimental group) were completely immunised.

4.3.5 Morbidity Pattern

Details of epidemics that had affected the index child during the past one year were enquired and are presented in Table 26.

Table 26. Morbidity pattern of index children

Epidemics occured	Control group			Experimental group		
	No.	%		No.	%	
Tuberculosis	1	1.43	}	0	0	}
Measles	4	5.71	}	1	1.25	}
Respiratory disease	4	5.71	} 15.71	2	2.50	} 3.75
Chicken pox	2	2.86	}	0	0	}
None	59	84.29		77	96.25	

Only 3.75 per cent of the children from the experimental group were found to be affected by epidemics while 15.71 per cent of children from the control group were affected by epidemic.

4.3.6 Availability of facilities at home

Details of facilities available to the children at home were studied and is presented in Table 27.

Table 27. Facilities available to the children at home

Facilities available	Control group		Experimental group	
	No.	%	No.	%
1	2	3	4	5
1. Own room				
Yes	0	0	0	0
No	70	100.00	80	100.00
2. Play materials				
Yes	56	80.00	66	82.50
No	14	20.00	14	17.50

Contd.

Table 27. Continued

1	2	3	4	5
3. Text books for learning				
Yes	41	58.57	31	38.75
No	29	41.43	49	61.25
4. Other books for acquiring additional knowledge				
Yes	22	31.43	11	13.75
No	48	68.57	69	86.25

As revealed in Table 27 none of the children in both groups had their own rooms. Children possessing play materials falls in the range of 80-82.5 per cent in both the control and the experimental groups respectively.

While the percentage of children possessing text books for learning and for acquiring additional knowledge were 58.57 and 31.43 respectively for the control group, the percentage of children in the experimental group possessing the same were 38.75 and 13.75 per cent.

4.3.7 Time taken and distance covered to reach the school

Table 28 depicts the time taken and distance covered to reach the school.

Table 28. Time taken and distance covered to reach the school

Facilities available	Control group		Experimental group	
	No.	%	No.	%
Time taken				
Within 15 minutes	67	95.71	68	85.00
15-30 minutes	3	4.29	10	12.50
Above 30 minutes	0	0	2	2.50
Total	70	100.00	80	100.00
Distance range				
Within 1/2 km	66	94.29	63	78.75
Within 1/2- 1 km	0	0	10	12.50
More than 1 km	4	5.71	7	8.75
Total	70	100.00	80	100.00

As revealed in the table, majority of the children in both the groups lived within a span of half kilometers and reached the school in 15 minutes.

4.3.8 Admission of the children in the school

Details regarding the admission of children in the AWC/BWC are presented in Table 29.

Table 29. Details of admission of children in AWC/BWC

Facilities available	Control group		Experimental group	
	No.	%	No.	%
Less than 1 year	1	1.43	4	5.00
1-2 years	0	0	3	3.75
2-3 years	5	7.14	14	17.50
3-4 years	52	74.29	52	65.00
4-5 years	12	17.14	7	8.75
Total	70	100.00	80	100.00

Table 29 indicates that majority of children in both the groups (74.29 and 65% in the control and experimental group respectively) were admitted to the school when they were between the age of 3 and 4 years. Over seventeen per cent in the control group and 8.75 per cent in the experimental group were admitted between 4 and 5 years of age.

4.3.9 Cleanliness of premises and index children

The details regarding the opinion of the mothers about the cleanliness of the school and premises and the index children were enquired and is presented in Table 30.

Table 30. Details regarding the cleanliness of the children

Details	Control group		Experimental group	
	No.	%	No.	%
Does the children takes bath daily				
Yes	70	100.00	80	100.00
No	0	0	0	0
How often does the child changes his/her clothes daily				
Once	1	1.43	0	0
Twice	43	61.43	61	76.25
Thrice	23	32.86	19	23.75
Four times	3	4.28	0	0

All the mothers in both the groups had a highly favourable opinion with regard to the cleanliness of the AWC and BWC and its premises in Table 30.

As revealed in Table 30, 100 per cent of children of both the groups took bath daily. Majority of children in both the groups (61.43% and 76.25% in the control and the experimental group respectively) changed their clothes twice a day.

4.3.10 Deworming of index children

Details regarding the deworming of children were enquired and are presented in Table 31.

Table 31. Details regarding the deworming of the children

	Control group		Experimental group	
	No.	%	No.	%
The child dewormed every six months				
Yes	52	74.29	68	85.00
No	18	25.71	12	15.00
Which medicine				
1) Allopathic medicine	51	98.11	61	89.71
2) Ayurvedic	1	1.89	6	8.82
3) Homeo			1	1.47

As revealed in the table, 70.29 per cent of the children in the control group and 85 per cent in the experimental group were regularly dewormed every six months while 25.71 per cent in the control group and 15 per cent of the children in the experimental group were unaware of the deworming practices.

It was also found that majority of the families who dewormed their children regularly used mainly allopathic medicines.

4.3.11 Behavioural problems of the children

Information on different behavioural problems of children are given in Table 32.

Table 32. Behavioural problems of the children

Behavioural problems	Control group				Experimental group			
	Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%
Nail biting	20	25.57	50	71.43	18	22.59	62	77.50
Bed wetting	7	10.00	63	90.00	12	15.00	68	85.00
Thumb sucking	4	5.71	66	94.29	7	8.75	73	91.25
Day dreaming	2	2.86	68	97.14	0	0	80	100.00
Sibling rivalry	33	47.14	37	52.86	40	50.00	40	50.00
Depression	0	0	70	100.00	0	0	80	100.00
Rebellious towards elders	24	34.29	46	65.71	5	6.25	75	93.75
Speech difficulty	1	1.43	69	98.57	0	0	80	100.00
Lethargic	0	0	70	100.00	0	0	80	100.00
Irregularity in studies	25	35.71	45	64.29	11	13.75	69	86.25
Playfulness	27	38.57	43	61.43	19	23.75	61	76.25
Quarrelsome	14	20.00	56	80.00	14	17.50	66	82.50
Saying lies	0	0	70	100.00	0	0	80	100.00
Kleptomona	0	0	70	100.00	0	0	80	100.00

As indicated in Table 32, the major behavioural problem prevalent among the children in both the groups was sibling rivalry (47.14% and 50% in the control and the experimental group respectively).

4.4 Assessment of children by the class teacher

Details concerning the behaviour of the children in the classroom, their intellectual performance, social behaviour pattern and participation in extra curricular activities were recorded as assessed by the class teachers and the results are presented in the following tables.

4.4.1 Behaviour of children in the classroom

Table 33 pictures the behaviour of the children in the classroom.

Table 33. Behaviour of children in classroom

Behaviour pattern	Control group				Experimental group			
	Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%
Fighting with friends	31	44.29	39	55.71	50	62.50	30	37.75
Rebellious towards teachers	48	68.57	22	31.43	27	33.75	53	66.25
Constant fear	7	10.00	63	90.00	6	7.50	74	92.50
Jealousy towards classmates	24	34.29	46	65.71	16	29.00	64	80.00
Revengeful towards classmates	34	48.57	36	51.43	33	41.25	42	58.75
Friendly towards classmates	69	98.57	1	1.43	77	96.25	3	3.75

As furnished in Table 33 among various behaviour patterns observed, fighting with friends and jealousy towards classmates were found to be predominant in both the groups. It was also observed that majority of the children in both the groups were friendly towards their classmates.

4.4.2 Intellectual performance of children

Table 34 gives informations on intellectual performance based on the various components of intelligence.

Table 34. Intellectual performance of children

Components of intelligence	Control group						Experimental group					
	Below average		Average		Above average		Below average		Average		Above average	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Reasoning capacity	27	38.57	39	52.72	4	5.71	4	5.00	70	87.50	6	7.50
Attention span	23	32.86	44	62.86	3	4.28	4	5.00	73	91.25	3	3.75
Memory	27	38.57	38	54.29	5	7.14	7	8.75	65	81.25	8	10.00
Imagination and creativity	32	45.71	36	51.43	2	2.86	5	6.25	71	88.75	4	5.00
Performance at school	24	32.28	44	62.86	2	2.86	4	5.00	72	90.00	4	5.00
Mean		38.00		57.43		4.57		6		87.75		6.25

As pictured in Table 34 majority of the preschoolers in the experimental group (87.75%) exhibited average intellectual peformance as compared to control group (57.43%) on further investigations it was found that the percentage of below average children were comparatively higher among control group.

4.4.3 Social behaviour pattern of the children

It was attempted to find out the social behaviour pattern of the children and the results are presented in Table 35.

Table 35. Social behaviour pattern of the children

Social behaviour	Control group				Experimental group			
	Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%
Talkative	45	64.29	25	35.71	47	58.75	33	41.25
Calm and quiet	10	14.29	60	85.71	15	18.75	65	81.25
Co-operative	68	97.14	2	2.86	78	97.5	2	2.50
Popularity in school	49	70.00	21	30.00	57	71.25	23	28.75
Acceptable behaviour	69	98.57	1	1.43	78	97.50	2	2.50
Sharing nature of own belongings with others	43	61.43	27	38.57	71	88.75	9	11.25
Friendly nature	70	100.00	0	0	80	100.00	0	0
Type of play preferred								
a) Group play	69	98.57	1	1.43	80	100.00	0	0
b) Solitary play	1	1.43	69	98.57	0	0	0	0

As revealed in the Table 35, 64.29 per cent of the children in the control group were talkative, while it was 58.75 per cent in the experimental group. Only 14.29 per cent in the control and 18.75 per cent in the experimental group were found to be calm and quiet. Almost 97 per cent in both the groups were found to be co-operative and had an acceptable behaviour. Seventy per cent in the control group and 71.25 per cent of the children in the experimental group were found to be popular in school. While only 61.43 per cent in the control group shared their own belongings with others 88.75 per cent of the children in the experimental group were of that habit. It was found that almost 100 per cent of the children of both the groups were of friendly nature and preferred group play rather than solitary play.

4.4.4 Participation in extra curricular activities

Table 36 furnishes informations regarding the extra curricular talents and participation of children in extra curricular activities.

Table 36. Participation in extra curricular activities

Activities	Control group				Experimental group			
	Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%
Extra curricular talents	41	58.57	29	41.43	41	51.25	39	48.75
Involvement in extra cturricular activities	32	45.71	38	54.29	40	50.00	40	5.00

It may be noted that eventhough 58.57 per cent of the children in the control group and 51.25 per cent in the experimental group had some extra

curricular talents, only 45.71 per cent of children in the experimental group and 50 percentage children in the control group were involved in extra curricular activities.

4.5 An appraisal of the ICDS programme implemented in the study area

An appraisal of the ICDS programme implemented in the study area will provide valuable information pertaining to the programme performance and its resource utilisation is provided in Table 37.

4.5.1 Purpose of participation

Distribution of the respondents according to the purpose of participation in the package of services.

Table 37. Purpose of participation

Package of service	Category	Control group		Experimental group	
		No.	%	No.	%
Supplementary food (WFP food)	Yes	0	0	80	100.00
	No	70	100.00	0	0
Immunization	Yes	0	0	77	96.25
	No	70	100.00	3	
Health check up	Yes	0	0	79	98.75
	No	70	100.00	1	1.25
Referral service	Yes	0	0	36	45.00
	No	70	100.00	44	55.00
Non-formal pre-school education	Yes	67	95.71	80	100.00
	No	3	4.29	0	0
Nutrition and health education for mother	Yes	0	0	80	100.00
	No	70	100.00	0	0

Supplementary nutrition, nutrition and health education for mothers, and non formal preschool education were found to be the persuading factors in the experimental group while in the non ICDS group. Non formal preschool education alone was found to be the persuading factor for participation in package of services.

4.5.2 Regularity in the AWC/BWC

Table 38 depicts the regularity of the children in attending the AWC/BWC.

Table 38. Regularity in AWC/BWC

Particulars	Control group		Experimental group	
	No.	%	No.	%
Regular	70	100.00	80	100.00
Not regular	--	-	--	-
Total	70	100.00	80	100.00

From the table it is clear that all the children in both the group were regular participants.

4.5.3 Participation of mothers in ICDS programme

Details whether the mother was a participant while she was carrying the index child was enquired and is recorded in Table 39.

Table 39. Participation of mothers in the ICDS programme

Particulars	Experimental group	
	No.	%
Whether a beneficiary while carrying the index child?		
Yes	58	72.50
No	22	27.50
Total	80	100.00

Table 39. revealed that of the 80 mothers whose children studied in the anganwadi, only 72.5 per cent attended the programme for pregnant mothers, while carrying the index child.

4.5.4 Food distribution system

Table 40 gives details regarding the food distribution system.

Table 40. Food distribution system followed in the anganwadi

Particulars	Experimental group	
	No.	%
1) On the spot feeding	76	95.00
2) Take home system	4	5.00
3) Others carried food home for the child	--	-
4) Raw food taken home	--	-
Total	80	100.00

As revealed in Table 40 majority of the anganwadies adhered to on the spot feeding system. The mothers of the children preferred on the spot feeding system as the child will consume and relish the food completely when he sits to eat in a group.

4.5.5 Details regarding the food supplement (Corn Soya Blend)

The food supplement served in the anganwadi centre named as corn soya blend (CSB) is an outstanding blended food product. It is considered as a full nutrition food, and has a high protein value. It is tasty, adaptable and economical. It can be easily prepared and can be served as fried cake, porridges, puddings, beverages, soups, cookies, meat extenders, stews and dumplings.

The content of CSB is as follows:

69.7 per cent corn meal processed gelatinised

22 per cent soy flour defatted, roasted

2.7 per cent mineral premix

0.1 per cent vitamin, antioxidant premix

5.5 per cent soya oil, refined, deodorised and stabilised

Details regarding the nutritive value of CSB is given in Table 41.

Table 41. Nutritive value of CSB

Nutrients	Quantity/100 g
Food energy (kilocalories)	380
Protein (g)	18
Carbohydrate (g)	60
Fat (g)	6
Vitamin A (IU)	1700
Vitamin D (IU)	200
Vitamin E (IU)	8
Thiamin (mg)	0.7
Riboflavin (mg)	0.5

Contd.

Table 41. Continued

Nutrients	Quantity/100 g
Niacin (mg)	8
Vitamin B_6 (mg)	0.7
Vitamin B_{12} (mcg)	4
Pantothenic acid (mg)	3
Folacin (mg)	0.2
Ascorbic acid (mg)	40
Calcium (mg)	600
Phosphorus (mg)	600
Magnesium (mg)	100
Iron (mg)	18
Zinc (mg)	3
Iodine (mcg)	50

It was seen that all the participants had a good opinion regarding the quality of the food supplement given. Regarding the quantity, while 95 per cent consumed the full ration, 5 per cent were wasting the food.

4.5.6 Recipes and time suitability

On further enquiry regarding the food supplement it was found that uppuma was commonly served in the AWC. Payasam or porridge was served only once in a week. It was found that the food was being served at 3 pm, which was suitable for everyone.

4.5.7 Facilities available at AWC/BWC

Table 42 furnishes information regarding the facilities available at the AWC/BWC.

Table 42. Facilities available at AWC/BWC

	Control group				Experimental group			
	Fully available		Partially available		Fully available		Partially available	
	No.	%	No.	%	No.	%	No.	%
Safe drinking water	70	100.00	-	-	80	100.00	-	-
Environmental hygiene	65	92.85	5	7.15	75	92.5	5	6.25
Building facility	50	71.42	20	28.58	57	71.25	13	28.75
Toilet facility	70	100.00	-	-	80	100.00	-	-
Facilities for play	68	97.14	2	2.86	77	96.25	3	3.75
Sleeping facilities	70	100.00	-	-	80	100.00	-	-
Facility for preparing food	70	100.00	-	-	80	100.00	-	-
Furniture facility	50	71.43	20	28.57	58	72.50	22	27.50

From Table 42, it was found that all facilities at the AWC/BWC were adequate except building facilities and furniture facilities.

4.6 Nutritional status of the children

4.6.1 Actual food and nutrient intake of selected preschool children (subsample)

Actual food and nutrient intake of the children belonging to the experimental and control groups were measured for 7 children in the control group and for 8 children in the experimental group, by a one day weighment survey to determine the quality and quantity of the food consumed by the children.

The actual quantity of food intake of the children belonging to both the control and the experimental group in comparison with the suggested dietary allowance by ICMR (1981) are presented in Table 43.

Table 43. Average food consumption of children (4-6 years)

Food groups	RDA* (g)	Control group		Experimental group	
		Average intake (g)	Percentage of RDA	Average intake (g)	Percentage of RDA
Cereals	270	122.77	45.55	126.09	46.70
Pulses	35	22.02	62.90	24.45	69.90
Green leafy vegetables	50	2.97	5.90	8.96	17.90
Other vegetables	30	37.72	125.70	21.46	71.50
Roots and tubers	20	24.00	120.00	30.51	152.55
Fruits	60	21.15	35.30	55.69	92.80
Milk	250	100.00	40.00	221.25	88.50
Meat/Fish/Egg	30	98.28	327.60	56.51	188.40
Fats and oils	25	10.78	43.12	12.24	48.96
Nuts and oil seeds		21.23		22.10	
Sugar and jaggery	40	8.52	21.30	8.36	20.90

* ICMR (1981)

Among the different food stuffs, consumption of cereals by both the groups were found to be insufficient (below 47%) as seen in Table 44. In both the groups more than 50 per cent of the RDA was met for food group like pulses, other vegetables, roots and tubers, fruits, meat, fish and egg. The inclusion of food groups

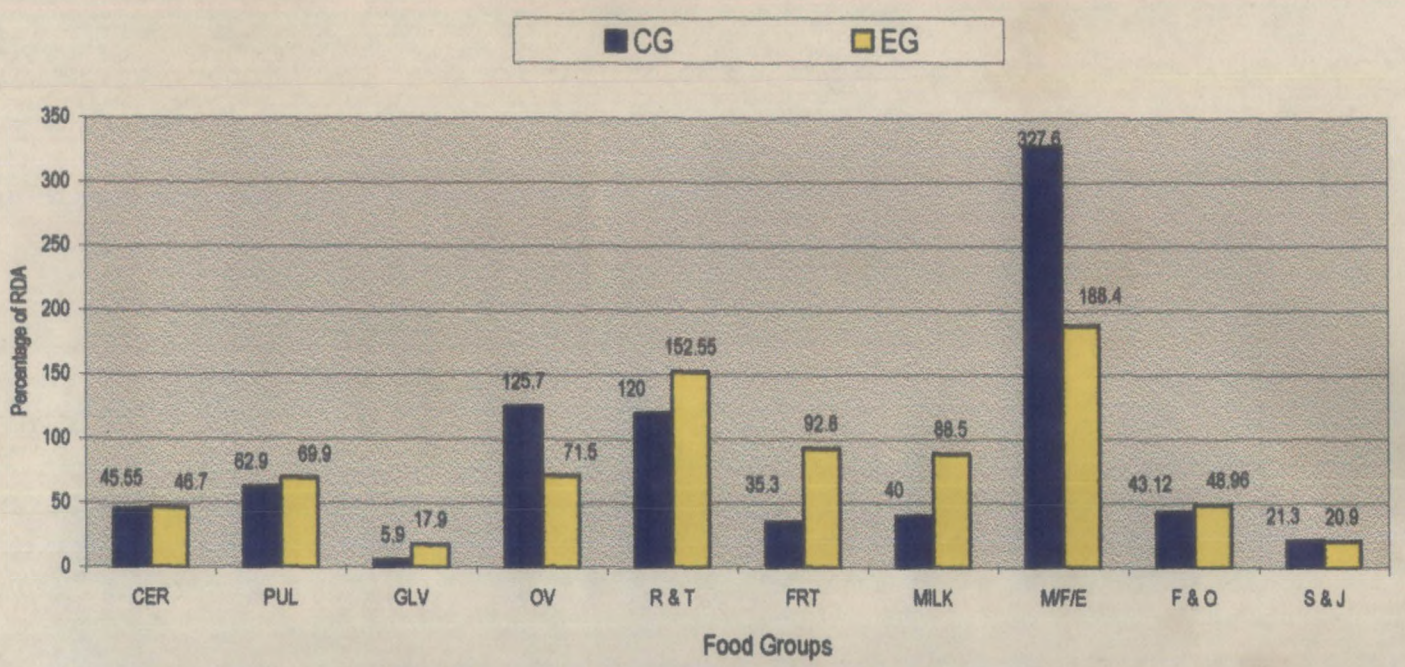


Fig 2. Average food consumption of children as percentage of RDA

CER - Cereals
PUL - Pulses
GLV - Green Leafy Vegetables
OV - Other Vegetables
R & T - Roots and tubers
FRT - Fruits
M/F/E - Meat/Fish/Egg
F & O - Fats & Oils
S & J - Sugar and Jaggery

like greenleafy vegetables [5.9% (CG) and 17.9% (EG)], sugar and jaggery [21.3% (CG) and 20.9% (EG)] were found to be low. On further analysis it was found that consumption of roots and tubers [120% (control group) and 152.5% (experimental group)] and fish/meat/egg [327.6% (control group) and 188.4% (experimental group)] were quite high among both the groups. The percentage of food intake of children in the control and the experimental group in comparison with the RDA is illustrated in Fig.2.

The intake of nutrients of the children were calculated, from the quantity of foods consumed by them and the details in comparison with the RDA are presented in Table 44.

Table 44. Average nutrient intake of children (4-6 years)

Nutrients	RDA* (g)	Control group		Experimental group	
		Quantity consumed	Percentage of RDA	Quantity consumed	Percentage of RDA
Energy (Kcal)	1690	993	58.75	1278	75.61
Protein (g)	30	37.35	124.50	46.08	153.60
Iron (mg)	18	8.05	44.72	19.56	108.67
ß-carotene (µg)	1600	430	26.88	1331	83.19
Thiamine (mg)	0.9	0.53	58.89	1.08	120.00
Riboflavin (mg)	1	0.57	57.00	0.97	97.00
Niacine (mg)	11	8.22	74.73	12.98	118.00
Vitamin C (mg)	40	20	49.78	47	118.33

*ICMR (1994)

As pictured in Table 45 the protein, iron, thiamine, niacin and vitamin-C intake of preschool children belonging to the experimental group was observed to

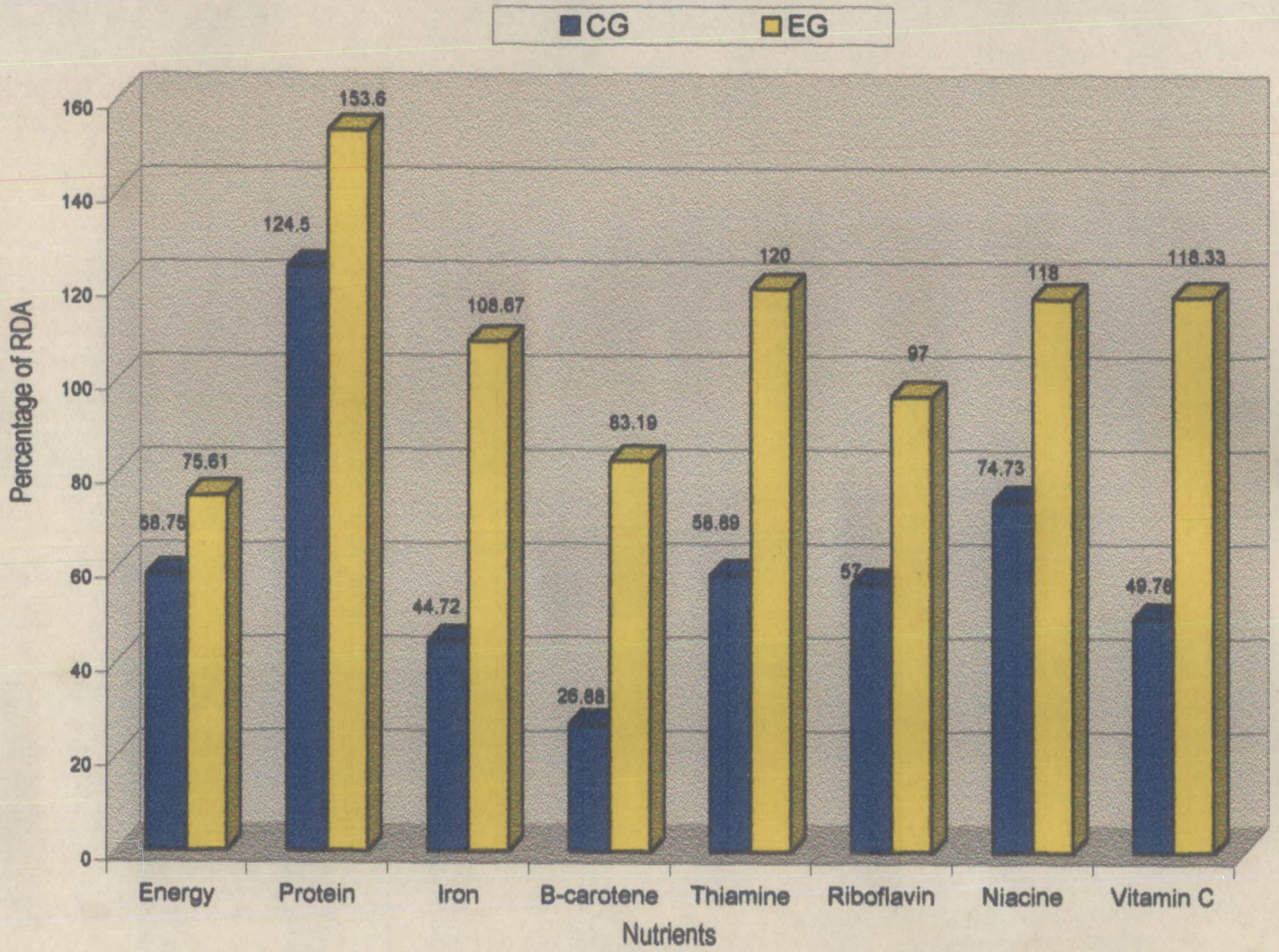


Fig3. Average nutrient of children as percentage of RDA

meet more than 100 per cent of the specified RDA, while the energy ß-carotene and riboflavin were 75.61, 83.19 and 97 percentage of the RDA respectively.

In the case of preschool children of control group, the protein intake was found to meet more than 100 per cent of the RDA (124.5%). The intake of energy, thiamine, riboflavin and niacin were found to be more than 50 per cent. Iron and vitamin-C intake was found to be 44.72 and 49.78 per cent of the RDA respectively. The intake of ß-carotene was found to be very low with value of 26.88 per cent. On further analysis, it was found that all the values of the control group except protein was found to be much lower than the nutrient intake of the experimental group. The percentage of nutrient intake of preschool children of both group in comparison with the RDA is projected in Fig.3.

Analysis of variance was done to find out the difference in the nutrient intake (energy, protein, iron and ß-carotene) of preschool children of the control and the experimental group and the results and the mean values are presented in Table 45 and 45(a) respectively.

Table 45. ANOVA for nutrient intake

Variable	Source	Degree of freedom	Sum of squares	Mean squares	F value	Prob
1	2	3	4	5	6	7
Energy	Between groups	1	388919.902	388919.902	24.583	0.0003
	Within group	13	205664.958	15820.381		
	Total	14	594584.860			

Table 45. Continued

1	2	3	4	5	6	7
Iron	Between group	1	542.695	542.695	52.379	0.0000
	Within group	13	134.693	10.361		
	Total	14	677.389			
Beta-carotene	Between group	1	3319826.681	3319826.681	73.356	0.0000
	Withing group	13	588330.079	45256.160		
	Total	14	3908156.760			

Table 45(a) Mean ± SD

Variable	Control group	Experimental group
Energy	989.109 ± 120.13	1311.430 ± 130.43
Iron	7.765 ± 4.36	19.822 ± 1.71
Beta-carotene	430.010 ± 246.53	1373.005 ± 178.75

The results showed that the intake of energy, iron and ß-carotene is found to be significantly better in the ICDS beneficiaries than the nonbeneficiaries.

Average percentage contribution of meals to the total intake of major nutrients were analysed and is presented in Table 46.

Table 46. Percentage contribution of meals to daily intake of major nutrients

Nutrients	Group	Total	Meals							
			Breakfast		Lunch		Tea		Supper	
			Qnty	%	Qnty	%	Qnty	%	Qnty	%
Energy	CG	992.94	242.24	24.40	290.96	29.30	186.57	18.79	273.15	27.51
	EG	1277.73	292.34	22.88	278.46	21.79	378.32	29.61	312.57	25.72
Protein	CG	37.35	6.54	17.51	9.32	24.95	8.72	23.35	12.77	34.19
	EG	46.08	5.76	12.50	8.37	18.20	17.63	38.30	14.31	31.00
Iron	CG	8.05	1.38	17.14	1.32	16.40	2.66	33.04	2.69	33.42
	EG	19.56	1.17	5.98	1.30	6.65	14.64	74.85	2.45	12.52
Beta carotene	CG	430.02	79.88	18.57	78.90	18.35	167.83	39.03	103.41	29.05
	EG	1331.06	123.47	9.28	65.10	4.89	996.00	74.83	146.49	11.00
Thiamine	CG	0.53	0.16	30.19	0.16	30.19	0.07	13.21	0.14	26.41
	EG	1.08	0.14	12.96	0.16	14.82	0.61	56.48	0.17	15.74
Riboflavin	CG	0.57	0.12	21.05	0.08	14.04	0.29	50.88	0.08	14.03
	EG	0.97	0.17	17.50	0.09	9.30	0.60	61.90	0.11	11.30
Niacin	CG	8.22	1.52	18.50	2.10	25.50	1.14	13.90	3.46	42.10
	EG	12.98	1.52	11.70	2.07	15.90	6.51	50.20	2.88	22.20
Vitamin C	CG	19.91	1.99	10.00	0	0	7.17	36.00	10.75	54.00
	EG	47.33	5.36	11.30	0.19	0.40	35.17	74.30	6.62	14.00

As revealed in Table 46 in the control, the nutrient contribution from break fast and lunch were found to be same while the contribution from tea and supper were also more or less same. In the experimental group, it was found that while the contribution of nutrients from break fast, lunch and supper were more or less same, the major contribution of nutrients were from the evening snacks.

4.6.2 Anthropometric measurements of the preschool children

Anthropometric measurements viz. height, weight, mid upper arm circumference, chest circumference and head circumference of preschool children belonging to the control and experimental groups were assessed and compared with suggested national and international standards and also classified according to their grades of malnutrition.

Table 47 reveals the comparison of heights and weights of preschool children belonging to the control and experimental groups with the national and international standards.

Table 47. Mean ± SD of height and weight of preschool children

Measure-ments	Mean ± SD				Standards			
	Control group		Experimental group		Indian standard (ICMR)		International standard (NCHS)	
	M	F	M	F	M	F	M	F
Height (cm)	100.64 ± 4.53	101.21 ± 5.24	102.48 ± 4.61	101.65 ± 5.7	113.51	112.24	109.8	108.3
Weight (kg)	13.95 ± 1.51	14.09± 1.91	14.7 ± 1.64	14.04 ± 1.77	19.30	18.70	18.7	17.7

ICMR (1994) Study on well to do Hydrabad children
NCHS (1976) NCHS growth charts, Rockvilla, MD

The Table revealed that the growth pattern of preschool children belonging to the control and the experimental groups were at a lower rate than those of Indian standards as well as international standards.

Table 48 reveals the comparison of head circumference, chest circumference and mid upper arm circumference.

Table 48. Mean ± SD of head circumference, chest circumference and mid upper arm circumference of preschool school

Measure-ments (cms)	Mean ± SD				Standards			
	Control group		Experimental group		Indian standard (NFI)		International standard (NCHS)	
	M	F	M	F	M	F	M	F
Head circumference	50.61 ± 1.90	50.04 ± 2.14	51.59 ± 2.05	50.60 ± 1.84	50.00	49.10	-	-
Chest circumference	48.60 ± 1.36	48.03 ± 1.25	49.33 ± 1.46	48.48 ± 1.38	51.10	52.10	-	-
Mid upper arm circum-ference	15.13 ± 1.09	15.47 ± 0.8	15.16 ± 1.32	15.19 ± 1.08	16.00	16.00	-	-

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

Table 48 revealed that the head circumference of male and female children were 50.61 cm and 50.04 cm respectively in the control group as against 51.59 and 50.6 in the experimental group and both groups were found to be better than the standards. Chest circumference was found to be 48.6 and 48.03 cm for boys and girls respectively in the control group whereas in the experimental group it was 49.33 and 48.45 cm for males and females respectively. Eventhough the chest circumference of the experimental group was slightly better than the control group, both the groups were found to have lower chest circumference when compared with standards.

Mid upper arm circumference were found to be 15.13 cm for males and 15.47 cm for females in the control group as against, 15.16 cm and 15.19 cm in the experimental group and these were much lower than the standard.

Analysis of variance was done to compare the anthropometric measurements viz. height, weight, mid upper arm circumference, chest cirfumference and head circumference of both the control and the experimental groups. The experimental group had significant difference in head circumference and chest circumference when compared to the control group. Table 49 gives the details of analysis of variance.

Table 49. ANOVA for anthropometric measurements

Variables	Source	Degree of freedom	Sum of squares	Mean squares	T value	Prob.
Chest circum-ference	Between group	1	10.772	10.772	5.320	0.0225
	Within group	148	299.670	2.025		
Total		149	310.442			
Head circum-ference	Between group	1	20.257	20.257	4.874	0.0288
	Within group	148	615.118	4.156		
Total		149	635.778			

Pre-school children were classified into different grades of malnutrition based on their height and weight deficit. This classification would enable us to detect the most needy children in many field oriented intervention programmes.

Prevalence of malnutrition among preschool children as per height for age according to Mclarens classification is presented in Table 50.

Table 50. Prevalence of malnutrition among pre-school children (Height for age - Mclarens classification)

Mclarens classification	ICMR						NCHS					
	CG			EG			CG			EG		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<80% - Dwarf	-	-	-	-	-	-	-	-	-	-	-	-
80-90% - Short	13 (37.14)	9 (25.71)	22 (31.43)	13 (32.50)	15 (37.50)	28 (35.00)	14 (40.00)	7 (20.00)	21 (30.00)	15 (37.50)	10 (25.00)	25 (31.25)
93-105% - Normal	22 (62.86)	26 (74.29)	48 (68.57)	27 (67.50)	25 (62.50)	52 (65.00)	21 (60.00)	28 (80.00)	49 (70.00)	25 (62.50)	30 (75.00)	55 (68.75)
Total	35	35	70	40	40	80	35	35	70	40	40	80

Numbers in parenthesis are percentage

As furnished in Table 50, according to ICMR standards, 65 per cent of the children in the experimental group were found to have normal height for age as against 68.57 per cent in the control group. Thirty five per cent children in the experimental group were identified short as against 31.43 per cent in the control group. When compared to NCHS standards majority of the children in the experimental and the control group (68.75 and 70% respectively) were having normal heights for age as thirty per cent children in the control group and 31.25 per cent children in the experimental group belonged to short stature group. When compared with both ICMR 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 51.

As pictured in Table 51 according to ICMR standards 51.25 per cent of the children in the experimental group were found to have normal height for age as against 47.14 per cent in the control group. Thirty seven point five per cent children in the experimental group and 35.71 per cent in the control group were having marginal malnutrition while 11.25 and 14.29 per cent in the experimental and the control groups respectively were moderately malnourished. When compared with NCHS standards, 48.75 per cent of children in the experimental group were found to have normal height for age as against 41.42 per cent in the control group. Forty three point seven five per cent in the experimental group and 42.86 per cent in the control group were having marginal malnutrition, while 7.5 and 12.86 per cent of children in the experimental and control groups respectively were moderately malnourished. When compared with the ICMR and NCHS standards 2.86 per cent of children in the control group belonged to the severely malnourished group.

Table 51. Prevalence of malnutrition among preschool children (Height for age - Waterlow's classification)

Waterlow's classification	ICMR						NCHS					
	CG			EG			CG			EG		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<85% - Severe malnutrition	0	2 (5.71)	2 (2.86)	0	0	0	0	2 (5.71)	2 (2.86)	0	0	0
85-90% - Moderate malnutrition	8 (28.86)	2 (5.71)	10 (14.29)	4 (10.00)	5 (12.50)	9 (11.25)	8 (22.86)	1 (2.86)	9 (12.86)	4 (10.00)	2 (5.00)	6 (7.50)
90-95% - Marginal malnutrition	14 (40.00)	11 (31.43)	25 (35.71)	15 (37.50)	15 (37.50)	30 (37.50)	15 (42.86)	15 (42.86)	30 (42.86)	19 (47.50)	16 (40.00)	35 (43.75)
>90% - Normal	13 (37.14)	20 (67.15)	33 (47.18)	21 (52.50)	20 (50.00)	41 (51.25)	12 (34.28)	17 (48.57)	29 (41.43)	17 (42.50)	22 (55.00)	39 (48.75)
Total	35	35	70	40	40	80	35	35	70	40	40	80

Numbers in parenthesis are percentage

Table 52. Prevalence malnutrition among preschool children (Height for age - Vishveswara Rao's classification)

Mc larens classification	ICMR						NCHS					
	CG			EG			CG			EG		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<80% - Poor	-	-	-	-	-	-	-	-	-	-	-	-
80-90% - Mild	8 (22.86)	4 (11.43)	12 (17.14)	4 (10.00)	5 (12.50)	9 (11.25)	8 (22.86)	3 (8.57)	11 (15.70)	4 (10.00)	2 (5.00)	6 (7.50)
91-100% - Normal	27 (77.14)	31 (88.57)	58 (82.86)	36 (90.00)	35 (87.50)	71 (88.75)	27 (77.14)	32 (91.43)	59 (84.29)	36 (90.00)	38 (95.00)	74 (92.50)
Total	35	35	70	40	40	80	35	35	70	40	40	80

Numbers in parenthesis are percentage

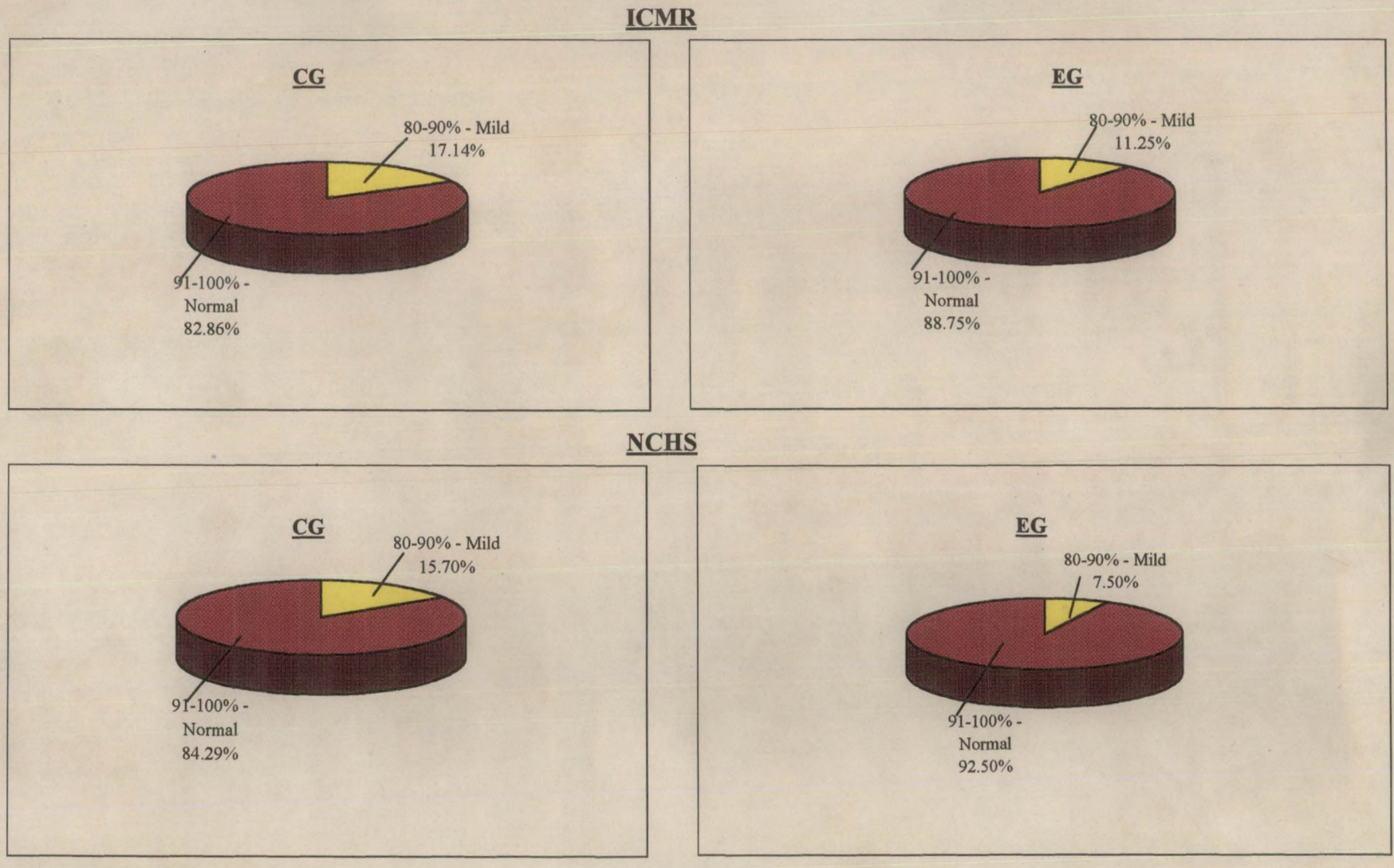


Fig.4. Prevalence of malnutrition among pre-school children (Height for age - Vishve shwara Rao's Classification)

Prevalence of malnutrition among children as per height for age according to Vishveshwara Rao's classification is presented in Table 52.

As depicted in Table 52 according to ICMR standards,88.75 of children in the experimental group were found to have normal height for age as against 82.86 per cent in the control group. Twelve point five per cent of children in the experimental group were identified to have mild retardation as against 17.14 per cent in the control group. Using NCHS standards, 92.5 per cent children in the experimental group and 84.29 per cent in the control group were having normal height for age. Mild retardation was found in 7.5 per cent and 15.71 per cent of children in the experimental and control groups respectively (Fig.4).

Prevalence of malnutrition among preschool children as per weight for age according to Gomez classification is given in Table 53.

As evidenced from Table 53, according to ICMR standards, 25 per cent of the children belonging to the experimental group and 25 per cent of the children belonging to the control group were found to have a normal weight for age. Majority of children in the experimental and the control group (55 and 52.86% respectively) were having Grade I malnutrition. Twenty per cent the children in the experimental group and 18.57 per cent in the control group were suffering from Grade II malnutrition. When compared with NCHS standards 13.75 and 14.29 per cent of children in the experimental group and the control group respectively were found to have normal weight for age. Sixty and 57.14 per cent of children of the experimental and the control groups respectively were having Grade I malnutrition. Grade II malnutrition was observed in 26.25 and 25.71 per cent of children in the experimental and control group respectively and 2.86 per cent of children in the control group belonged to the Grade III malnutrition.

Table 53. Prevalence of malnutrition among children (Weight for age - Gomez classification)

Gomez classification	ICMR						NCHS					
	CG			EG			CG			EG		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<60% - Grade III malnutrition	-	-	-	-	-	-	1 (2.86)	1 (2.86)	2 (2.86)	-	-	-
61-75% - Grade II malnutrition	7 (20.00)	6 (17.14)	13 (18.57)	9 (22.50)	7 (17.50)	16 (20.00)	12 (34.29)	6 (17.14)	18 (25.71)	12 (30.00)	9 (22.50)	21 (25.25)
76-90% - Grade I malnutrition	22 (62.86)	15 (42.86)	37 (52.86)	18 (45.00)	26 (65.00)	44 (55.00)	20 (57.14)	20 (57.14)	40 (57.14)	21 (52.50)	27 (67.50)	48 (60.00)
>90% - Normal	6 (17.14)	14 (40.00)	20 (28.57)	13 (32.50)	7 (17.50)	20 (25.00)	2 (5.71)	8 (22.86)	10 (14.29)	7 (17.50)	4 (10.00)	11 (13.75)
Total	35	35	70	40	40	80	35	35	70	40	40	80

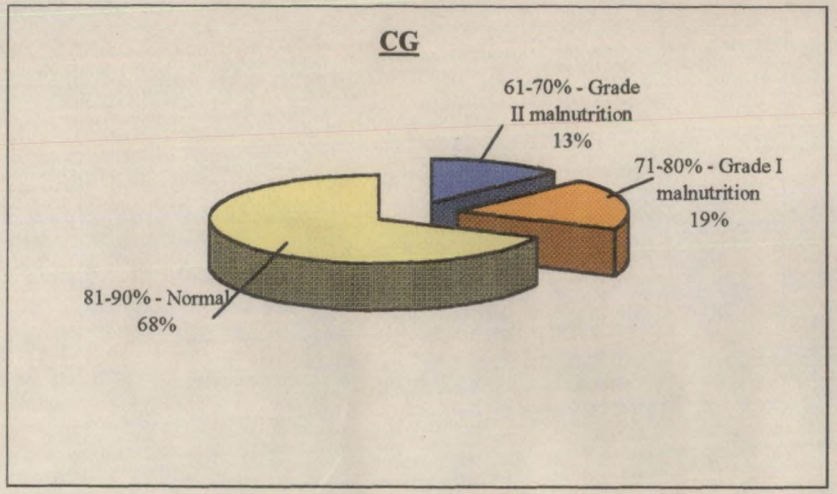
Numbers in parenthesis are percentage

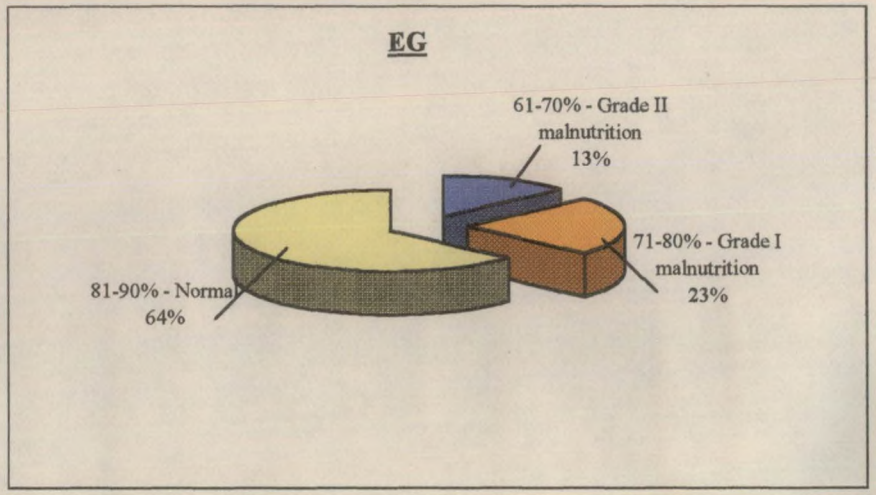
Table 54. Prevalence of malnutrition among preschool children (weight for age - IAP classification)

IAP classification	ICMR						NCHS					
	CG			EG			CG			EG		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<50% - Grade IV malnutrition	-	-	-	-	-	-	-	-	-	-	-	-
51-60% - Grade III malnutrition	-	-	-	-	-	-	1 (2.86)	1 (2.86)	2 (2.86)	-	-	-
61-70% - Grade II malnutrition	5 (14.27)	4 (11.43)	9 (12.86)	3 (7.50)	3 (7.50)	6 (14.29)	5 (11.43)	4 (12.86)	9 (5.00)	2 (5.00)	2 (5.00)	4 (5.00)
71-80% - Grade I malnutrition	6 (17.14)	7 (20.00)	13 (18.57)	9 (22.50)	11 (27.50)	20 (25.00)	17 (48.57)	10 (28.57)	27 (38.57)	15 (37.50)	16 (40.00)	31 (38.75)
81-90% - Normal	24 (68.57)	24 (68.57)	48 (68.57)	28 (70.00)	26 (65.00)	54 (67.50)	12 (34.29)	20 (57.14)	32 (45.71)	23 (57.50)	22 (55.00)	45 (56.25)

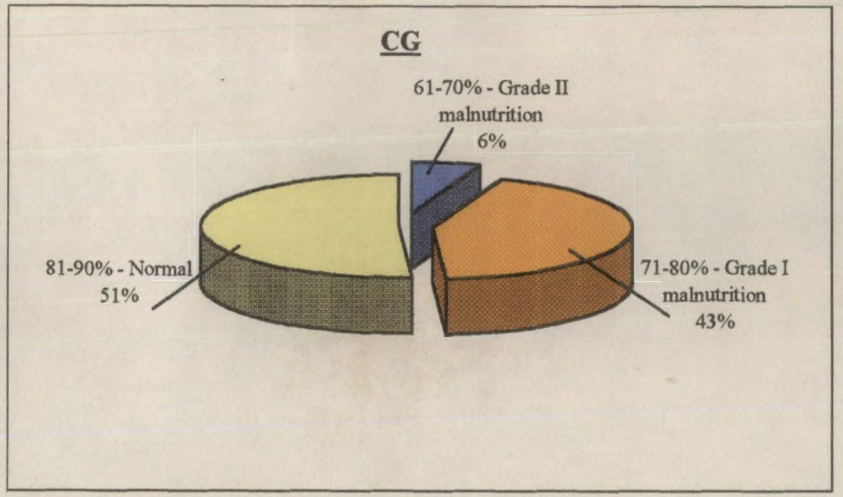
Numbers in parenthesis are percentage

ICMR





NCHS



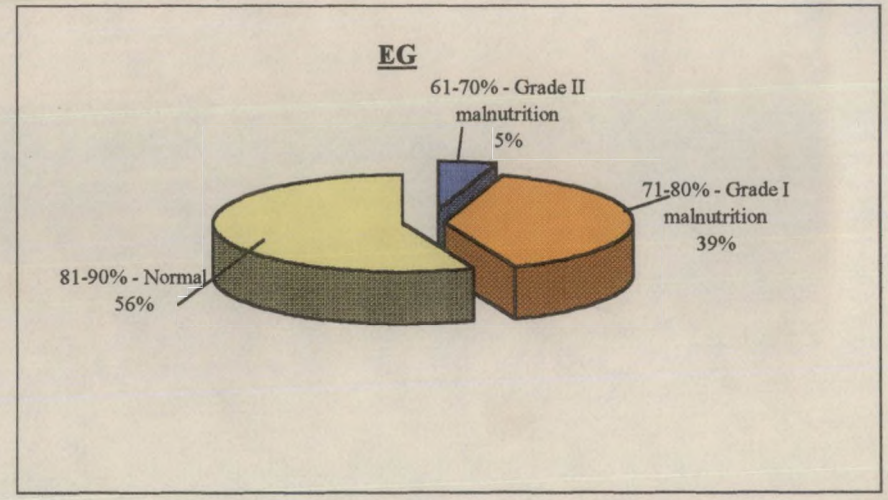


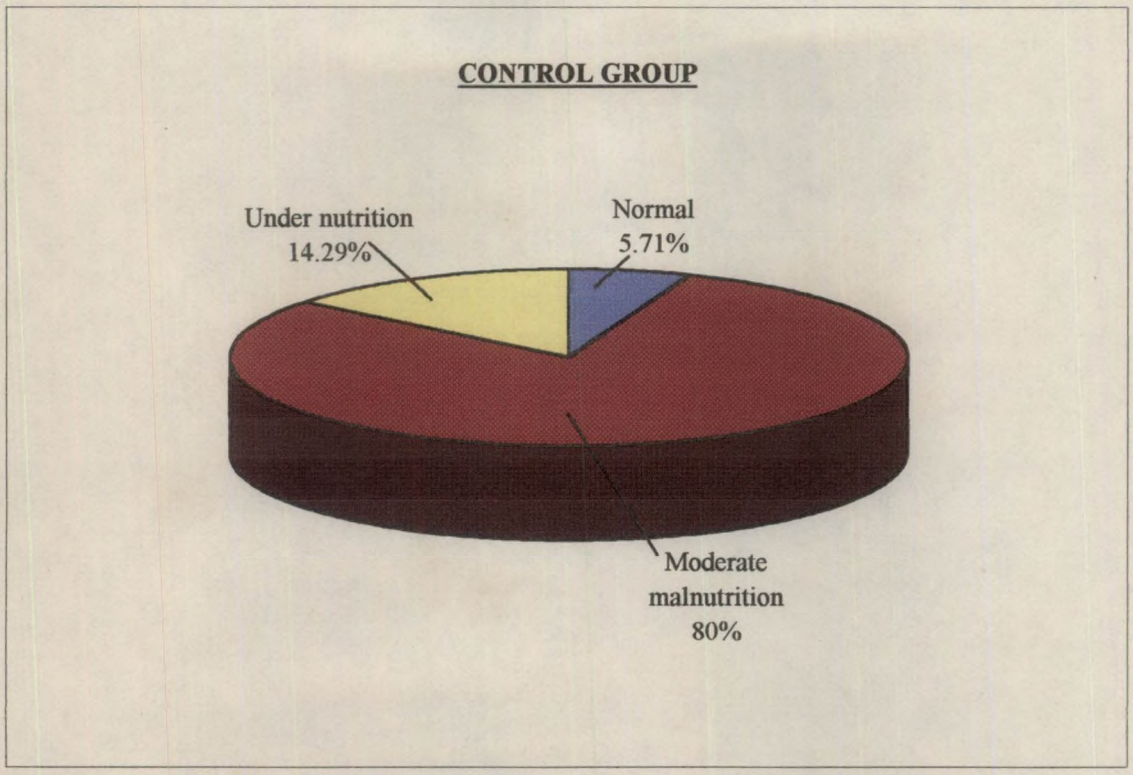
Fig.5. Prevalence of malnutrition among pre-school children (Weight for age - IAP Classification)

Distribution of children according to the gradation of growth retardation is made and Table 54 depicts the distribution of children according to the degree of malnutrition as suggested by Indian Academy of Pediatrics.

As evidenced from Table 54, according to Indian Academy of Pediatrics. Classification majority of children in both the experimental and the control groups (67.5 and 68.57% respectively) were found to be normal. Twenty five per cent of children in the experimental group and 18.57 per cent in the control group were identified under Grade I malnutrition, while only 7.5 per cent in the experimental group belonged to Grade II malnutrition as against 12.86 per cent in the control group.

When compared with NCHS standards, same trend was observed with majority of children in both the experimental and control group (56.25 and 45.71% respectively) falling under the normal weight for age group. Around 39 per cent of the children in both the groups belonged to the Grade I malnutrition. Only 5 per cent of the children in the experimental group were identified under grade II malnutrition as against 12.86 per cent and 2.86 per cent of children in the control group under grade II and grade III malnutrition respectively. None belonged to Grade IV malnutrition using both ICMR as well as NCHS standards (Fig.5).

Weight/height^2 is another index used to classify the children into different grades of malnutrition weight/height^2 profile was worked out as suggested by Rao and Singh for the two groups of the children and were classified accordingly, the details of which are presented in Table 55.



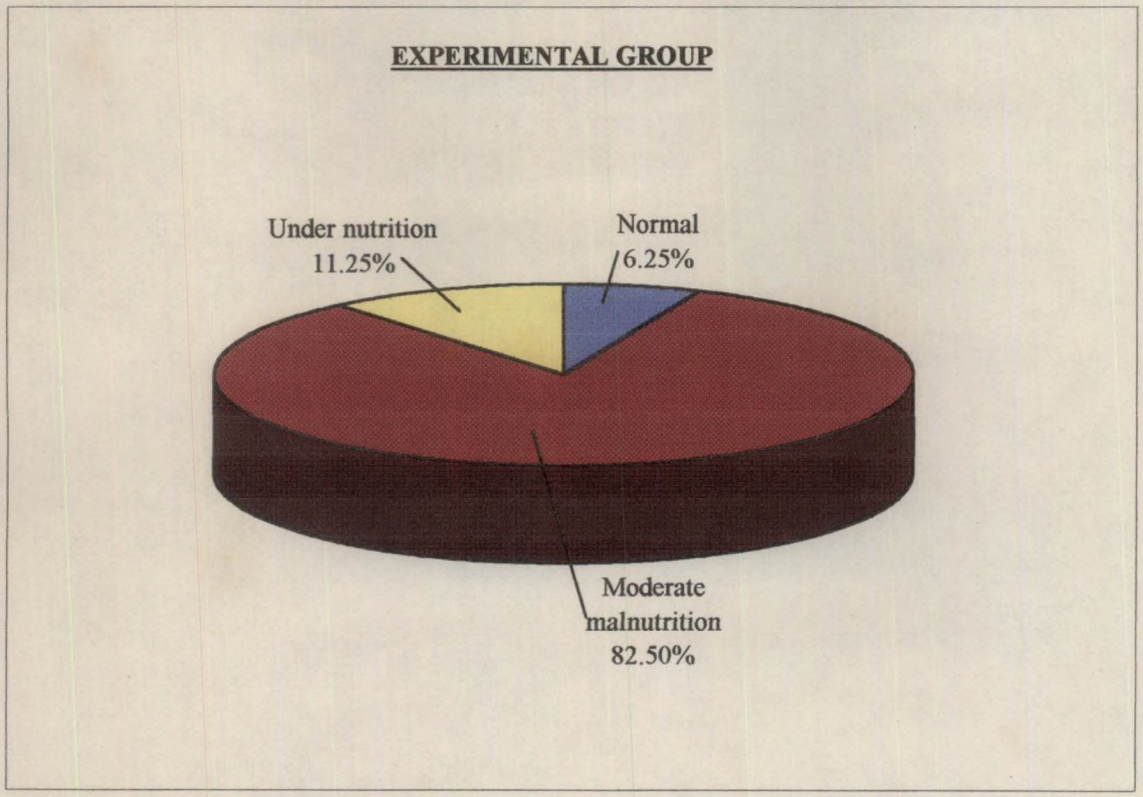


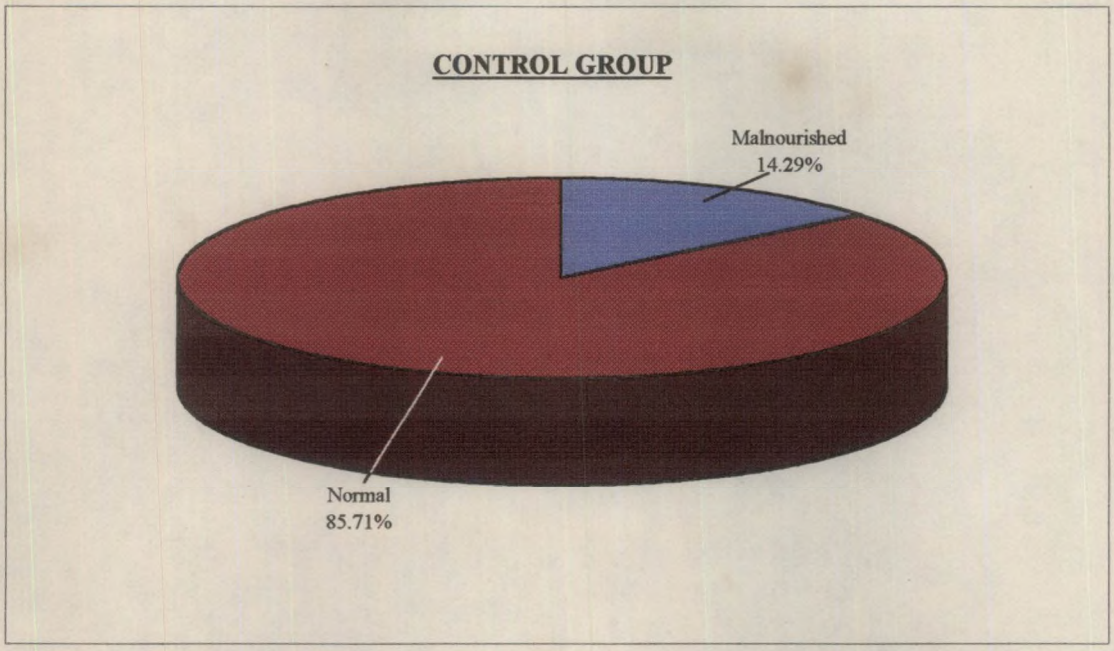
Fig.6. Distribution of children according to Wt/Ht2 profile (Rao and Singh)

Table 55. Distribution of children according to the weight/height² (Rao and Singh)

Weight/height²	Control group		Experimental group	
	No.	%	No.	%
Normal (> 0.0015)	4	5.71	5	6.25
Moderate malnutrition (0.0013-0.0015)	56	80.00	66	82.50
Under nutrition (< 0.0013)	10	14.29	9	11.25
Total	70	100.00	80	100.00

As revealed in Table 55, 6.25 per cent in the experimental group and 5.71 per cent in the control group were found to be normal. Eighty per cent in the experimental group and 82.5 per cent in the control group were found to suffer from moderate malnutrition. The percentage of children having under nutrition were found to be 11.25 in the experimental group and 14.29 in the control group (Fig.6).

Head/chest circumference ratio was applied for identifying the normal and malnourished children in the study group as suggested by Tara Gopaldas. Distribution of children according to head/chest circumference ratio is presented in Table 56.



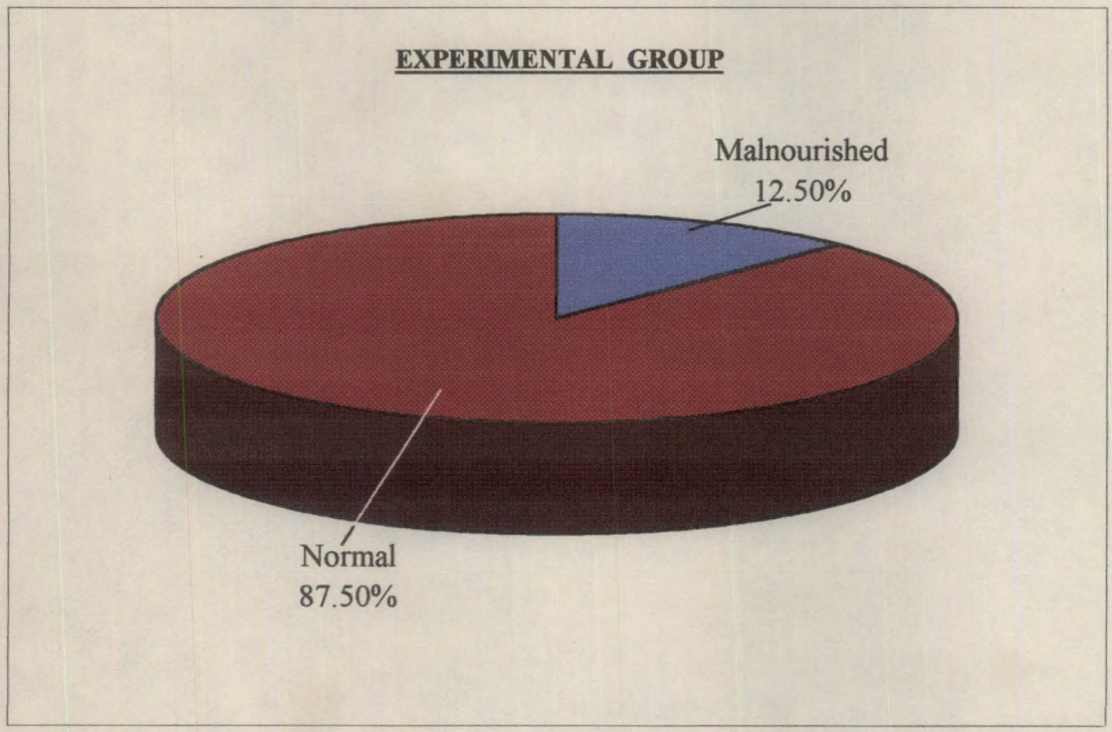


Fig.7. Distribution of children according to head/chest circumference ratio (Tara Gopaldas)

Table 56. Distribution of children according to head/chest circumference ratio (Tara Gopaldas)

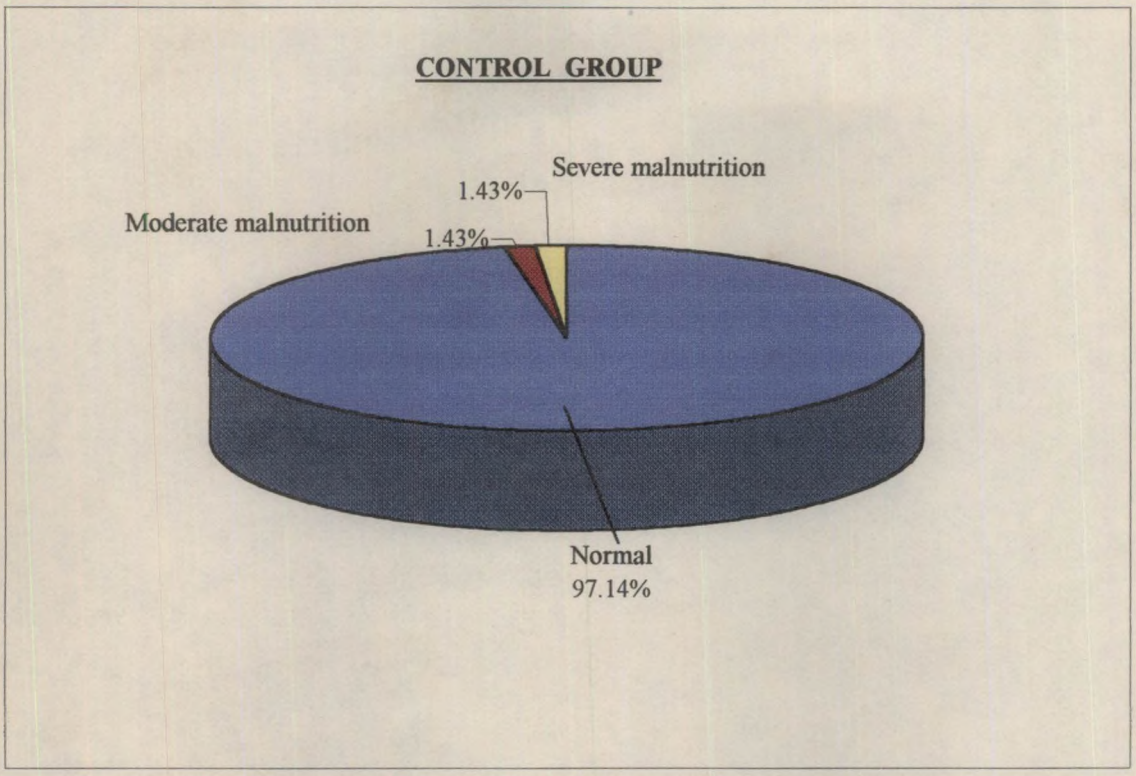
Head/chest circumference	Control group		Experimental group	
	No.	%	No.	%
Malnourished (> 1)	10	14.29	10	12.50
Normal (< 1)	60	85.71	70	87.50

From Table 56, it is clear that 87.5 per cent of children in the experimental group and 85.71 per cent of the children in the control group were found to be normal. According to head/chest circumference ratio malnourished children identified was 12.5 per cent in the experimental group as against 14.29 per cent in the control group (Fig.7).

Mid upper arm circumference is used as an indicater for screening the severely malnourished children. Mid upper arm circumference of the children were worked out as suggested by Tara Gopaldas and is presented in Table 57.

Table 57. Distribution of children according to mid upper arm circumference (Tara Gopaldas)

Mid upper arm circumference	Control group		Experimental group	
	No.	%	No.	%
Normal (>13.5)	68	97.14	79	98.75
Moderate malnutrition (12.5-13.5)	1	1.43	1	1.25
Severe malnutrition (< 12.5)	1	1.43	0	0



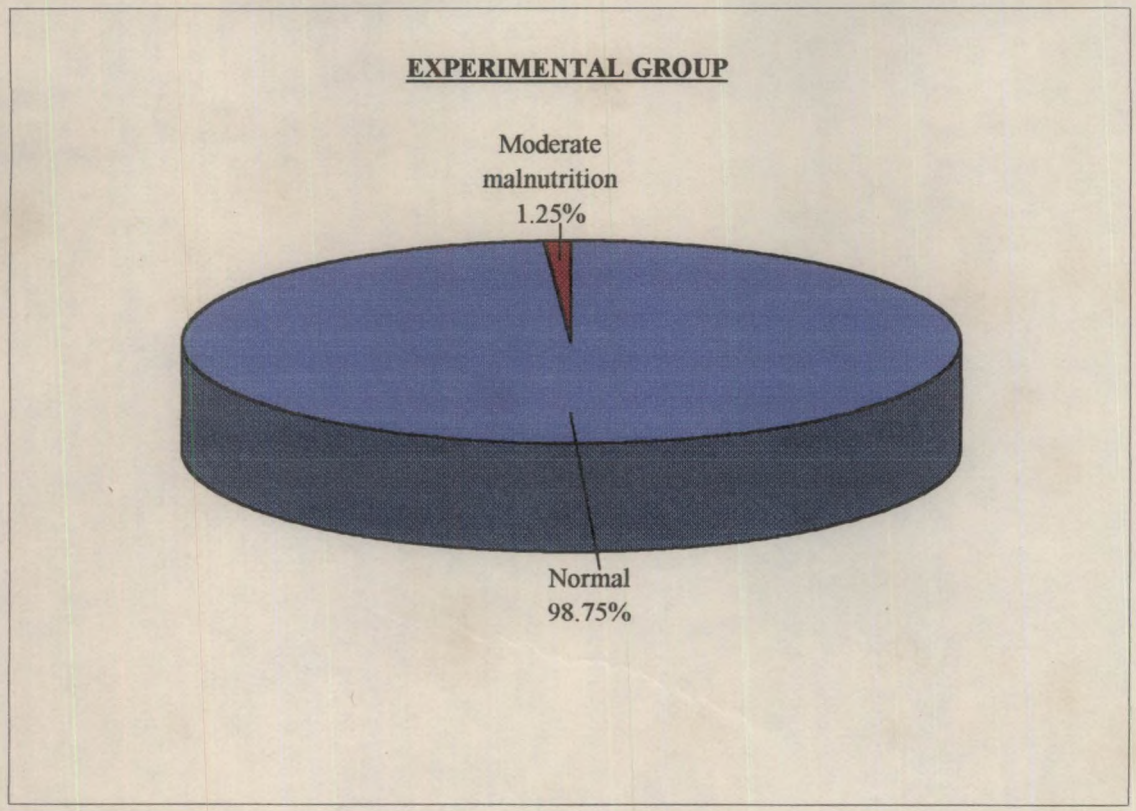


Fig.8. Distribution of children according to mid upper arm circumference (Tara Gopaldas)

Table 57 revealed that majority of the children in both experimental and the control groups (98.75 and 97.14% respectively) belonged to the normal group. While 1.25 and 1.43 per cent of children in the experimental and the control groups were moderately malnourished. Severe malnourishment was found in 1.43 per cent of children in the control group (Fig.8).

4.6.3 Biochemical profile of the selected preschool children (subsample)

The blood haemoglobin was estimated among 15 samples, drawing 7 children from the control group and 8 children from the experimental group and the haemoglobin values were compared with the standard values suggested by WHO as given by Gopaldas and Seshadri (1987) and the results are given in Table 58.

Table 58. Details regarding the haemoglobin level of the subsample

Haemoglobin level (g/dl)	Control group		Experimental group	
	No.	%	No.	%
> 11 (Acceptable)	-	-	6	75.00
10-10.9 (Low)	1	14.29	1	12.50
< 10 (Deficient)	6	85.71	1	12.50
Total	7	100.00	8	100.00

As it is evidenced from Table 58, 75 per cent of the preschool children in the experimental group were found to have acceptable levels of iron status. Twelve

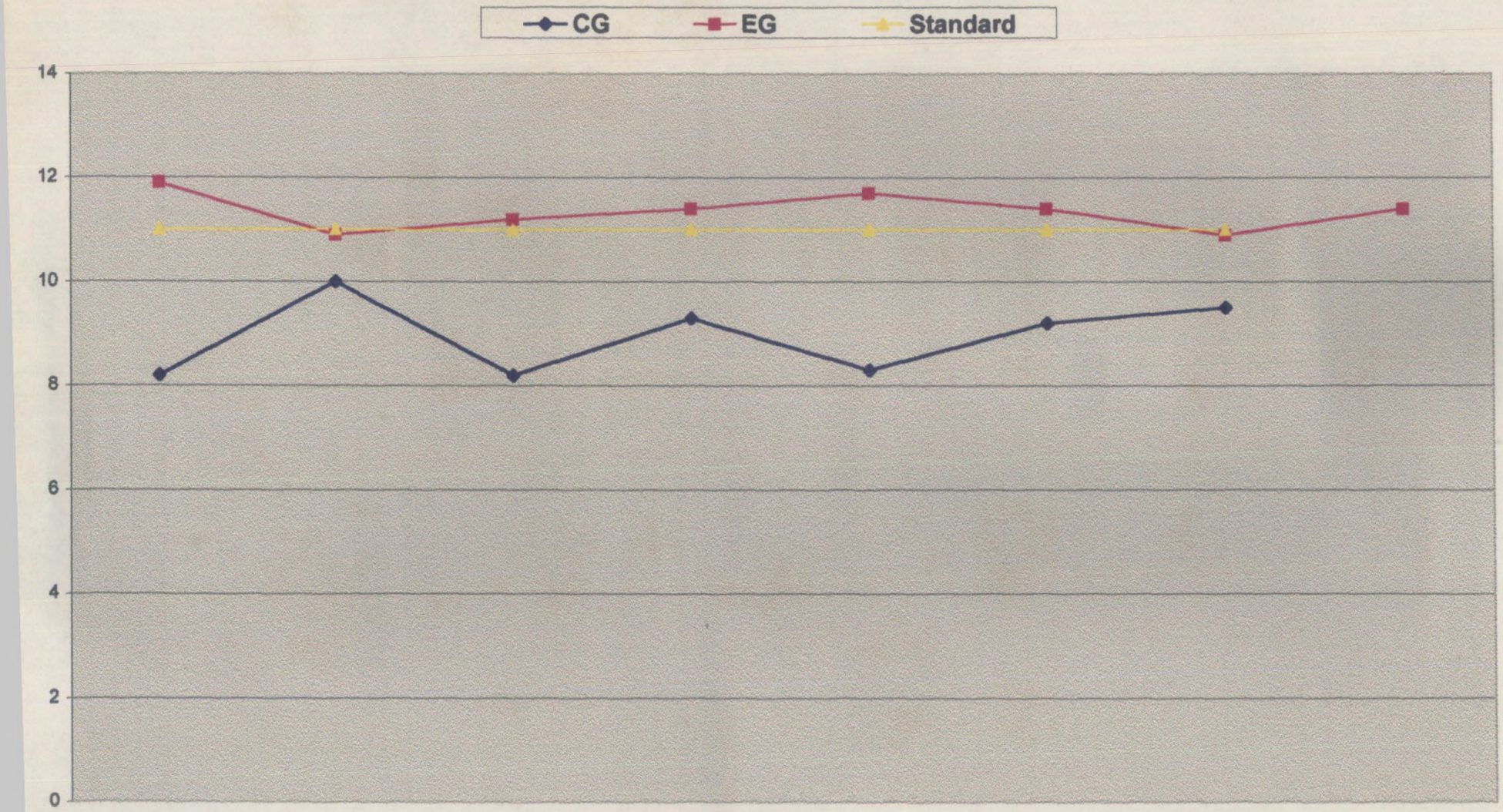


Fig.9. Haemoglobin level of children

point five per cent in the experimental group and 14.29 per cent in the control group had low iron status and only 12.5 per cent in the experimental group had deficient levels of haemoglobin as against 85.71 per cent of the children in the control group. The iron status of preschool children on the basis of haemoglobin level is presented in Fig.9.

4.6.4 Clinical assessment of selected preschool children (subsample)

Incidence of clinical signs and symptoms as per the NIN schedule observed among 7 children in the control group and 8 children in the experimental group are presented in Table 59.

Table 59. Details regarding the clinical signs present in the subsample

Clinical signs	Control group		Experimental group	
	No.	%	No.	%
Anaemia	3	42.85	-	-
Dental caries	1	14.29	-	-
Anaemia and Dental caries	2	28.57	-	-
None	1	14.29	8	100.00
Total	7	100.00	8	100.00

Table 59 revealed that cent per cent of children in the experimental group were found to be totally free from any clinical signs of deficiency as against 14.29 per cent in the control group. The rest of the children in the control group suffered from anaemia (42.85%), dental caries (14.29%) and both (28.57%).

4.7 Intelligence of the children

The intelligence quotient (IQ) of 150 preschool children were tested using "Mathew's Test of Mental Abilities". Their performance was scored and IQ was calculated and is presented in Table 60.

Table 60. Distribution of children according to their IQ

IQ range	Control group		Experimental group	
	No.	%	No.	%
Below 70 (very low)	-	-	-	-
70-79 (low)	-	-	-	-
80-89 (Borderline)	33	47.14	12	15.00
90-109 (Average)	33	47.14	43	53.75
110-119 (Bright)	1	1.43	13	16.25
120-129 (Superior)	2	2.86	5	6.25
130 and above (very supervisor)	1	1.43	7	8.75
Total	70	100.00	80	100.00

Table 60 revealed that none of the children in either the control or the experimental group, belonged to the `very low' or `low' IQ category. Fifteen per cent of the children in the experimental group were in the `border line', as against 47.14 per cent in the control group. Majority of the children in the experimental group belonged to `average' IQ range while it was 47.14 per cent in the control group. Sixteen point two five per cent of children belonged to the `bright' group as

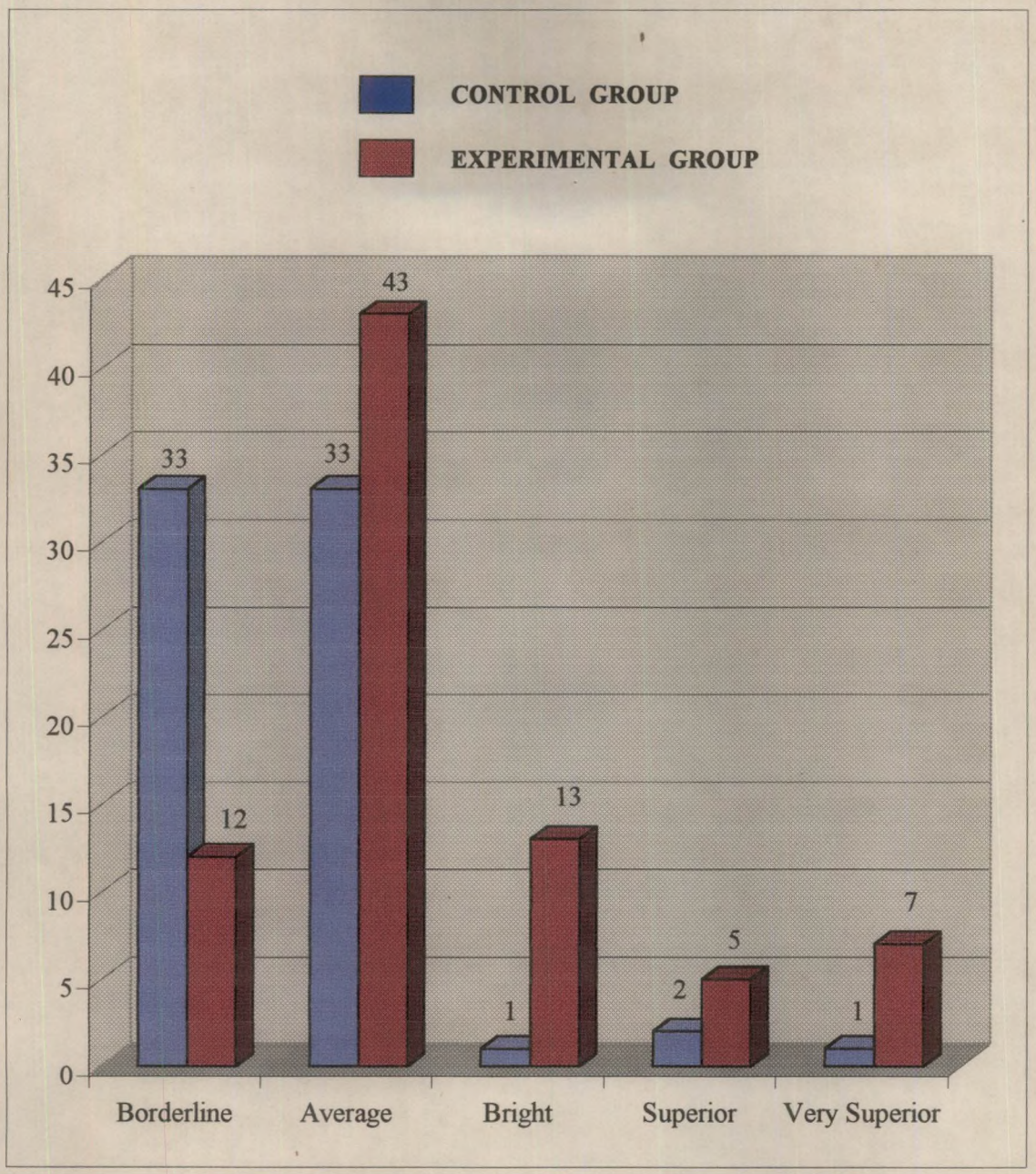


Fig.10 Distribution of children according to their IQ

against only 1.43 per cent in the control group. Six point two five per cent and 2.86 per cent children in the experimental and the control group respectively were with 'superior' IQ and 8.75 per cent and 1.43 per cent of children in the experimental and the control group respectively had an IQ ranging above 130, which showed that they were 'very superior' than the rest of the children (Fig.10).

The analysis of variance test was done to compare the IQ of experimental and control groups and the results are presented in Table 61.

Table 61. ANOVA for IQ

Source	Degree of freedom	Sum of square	Mean square	F value	Prb.
Between groups	148	5488.583	5488.583	28.171	0.0000
Within groups	148	28834.750	194.829		
		34323.333			

The results indicated that there is a significant difference in the IQ between two groups ie. the IQ of the experimental group is found to be significantly better than the IQ of the control group. The mean value of the IQ of the experimental group was 105.725 as against 93.600 in the control group.

4.8 Association between nutritional status and Intelligence

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

Multiple linear regression of IQ on the nutrient consumption (Energy, Protein, iron and carotene) was fit to the data collected and the parameters of the model were estimated for the experimental group and the control group separately and the regression was found to be nonsignificant. The same process was done considering the experimental and the control groups together and the results are presented in Table 62 and 62(a).

Table 62. Multiple regression of IQ on nutrient consumption

Variables	Regression coefficient	Standard partial regression coefficient	Student 't' value	Prob.
Energy	-0.017	-0.23	-0.504	0.622
Protein	0.495	0.27	0.999	0.335
Iron	0.678	0.31	0.783	0.447
ß-carotene	0.016	0.56	1.651	0.121

Intercept = 75.768949

R^2 = 0.621

Table 62(a). Correlation coefficient

Variable	Correlation coefficient
Energy	0.65*
Protein	0.563**
Iron	0.675*
ß-carotene	0.749*

* Significant at 1% level

** Significant at 5% level

Regression equation is

IQ = 75.77 - 0.017 Energy + 0.495 protein + 0.678 Iron + 0.016 carotene

According to the regression equation 62.1 per cent variation in IQ of both the experimental and the control groups together was expalined by the 4 variables viz. energy, protein, iron and ß-carotene of which the values of energy, iron and carotene are significant at 1 per cent level. It was also observed that more than 50 per cent of the variation in IQ was explained, when each variable was regressed separately.

Thus it is clear that nutrient consumption has a positive correlation with IQ when both the groups are considered together. The negative regression coefficient for energy must be due to multicollinearity. `F' is also significant with a value of 4.10.

Comparison of the various anthropometric indices with the IQ of preschool children are presented in Table 63.

Comparison of weight/height^2 ratio with IQ as given in Table 63 revealed that of the 6.25 per cent of children in the experimental group and 5.71 per cent in the control group with normal height and weight, 3.75 per cent in the control group and 4.29 per cent in the experimental group belonged to the average IQ group. The rest of the children in both the group were found to have an IQ above the average level. Among children with moderate malnutrition in the experimental group (82.5%) majority of the children (45%)belonged to the average IQ group while in the 80 per cent moderately malnourished children 38.5 per cent were having border line IQ. In the under nourished group majority of the children in both the experimental and control groups belonged to the border line IQ and 1.25 per cent of the experimental group had a very superior IQ.

Table 63. Distribution of children by various anthropometric indices with IQ

Anthropometric Index	Classification	Borderline (80-89)		Average (90-100)		Bright (110-119)		Superior (120-129)		Very superior (130 and above)		Total	
		CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
Weight/height²	Normal (>0.0015)	0	0	3 (4.29)	3 (3.75)	0	1 (1.25)	1 (1.43)	0	0	1 (1.25)	4 (5.71)	5 (6.25)
	Moderate malnutrition (0.0013-0.0015)	27 (38.57)	8 (10.00)	26 (37.14)	36 (45.00)	1 (1.43)	12 (15.00)	1 (1.43)	5 (6.25)	1 (1.43)	5 (6.25)	56 (80.00)	66 (82.50)
	Undernutrition (<0.0013)	6 (8.57)	4 (5.00)	4 (5.71)	4 (5.00)	0	0	0	0	0	1 (1.25)	10 (14.29)	9 (11.25)
Head circum-ference : Chest circumference	Normal (<1)	27 (38.57)	10 (12.50)	31 (44.29)	39 (48.75)	1 (1.43)	10 (12.50)	2 (2.86)	5 (6.25)	1 (1.43)	6 (7.50)	62 (88.57)	70 (87.50)
	Nalnourished (>1)	6 (8.57)	2 (2.50)	2 (2.86)	4 (5.00)	0	3 (3.75)	0	0	0	1 (1.25)	8 (11.43)	10 (12.50)
MUAC	Normal (>13.5)	31 (44.29)	12 (15.00)	33 (47.14)	42 (52.50)	1 (14.3)	13 (16.25)	2 (2.86)	5 (6.25)	1 (1.43)	7 (8.75)	68 (97.14)	79 (98.75)
	Moderate malnutrition (12.5-13.5)	1 (1.43)	0	0	1 (1.25)	0	0	0	0	0	0	1 (1.43)	1 (1.25)
	Severe malnutrition (<12.5)	1 (1.43)	0	0	0	0	0	0	0	0	0	1 (1.43)	0

Numbers in parenthesis are percentage

As depicted in Table 63 the comparison of head circumference : chest circumference ratio of children of the experimental and the control groups with IQ was done.

Eighty seven point five per cent of the experimental group were normal children. Of them 48.75 per cent were having an average IQ as against 44.29 per cent in the 88.57 per cent of normal children in the control group. In the experimental group about 12.5 per cent children were found to be in the borderline, 6.25 per cent in the superior and 7.5 per cent in the very superior IQ group, as against 38.57 per cent of children in the control group in the border line, 2.86 per cent in the superior and 1.43 per cent each in the bright and the very superior IQ groups.

Twelve point five per cent of children in the experimental group and 11.43 per cent of the control group were malnourished. Eight point five seven per cent in the experimental group and 2.5 per cent in the control group were in the border line IQ group, 2.86 per cent in the experimental group and 5 per cent in the control group was in the average and 3.75 per cent and 1.25 per cent in the experimental group in the bright and very superior IQ group respectively.

Distribution of children by mid upper arm circumference and IQ, is also provided in Table 63. In the case of the normal category, majority of children of the experimental group (52.5%) and the control group (47.14%) were having an average IQ. About 15 per cent in the experimental group and 44.29 per cent in the control group were found in the borderline, 16.25 per cent of the experimental group and 1.43 per cent of the control group in the bright, 6.25 per cent and 2 per cent in the experimental and the control group respectively in the superior group and 8.75 per cent and 1.43 per cent in the experimental and the control group

respectively in the very superior IQ group. Among the moderately malnourished children, 1.25 per cent in the experimental group belonged to the average IQ group and 1.43 per cent in the control group in the borderline group. In the severe malnutrition group only 1.43 per cent of children in the control group belonged to the borderline IQ group.

Multiple regression of IQ on the anthropometric measurements viz. weight/height^2, head circumference : chest circumference and mid upper arm circumference was fit to the data collected and the parameters of the model were estimated for both the experimental and control groups separately and it was found that in the experimental group only 8.7 per cent variation in IQ was explained by the anthropometric mesurements and as against 5.4 per cent in the control group and the regression was found to be non significant.

The same procedure was repeated considering both the experimental and the control groups together and the results are presented in Table 64 and 64a.

Table 64. Multiple regression of IQ on anthropometric measurements

Variables	Regression coefficient	Standard partial regression coefficient	Student 't' value	Prob.
Height	0.226	0.08	0.656	0.513
Weight	2.82	0.32	2.128	0.035
Mid upper arm circumference	-0.22	-0.02	-0.177	0.860
Chest circumference	1.19	0.11	1.355	0.177
Head circum-ference	-0.04	-0.005	-0.047	0.962

Intercept = -15.311498

R^2 = 0.184

Table 64(a). Correlation Coefficient

Variables	Correlation Coefficient
Height	0.350**
Weight	0.409**
Mid upper arm circumference	0.185**
Chest circumference	0.244**
Head circumference	0.314**

** - Significant at 1% level

Regression Equation is

IQ = -15.31 + 0.225 height + 2.82 weight - 0.22 mid upper circumference + 1.19 chest circumference - 0.04 head circumference

According to the regression equation 18.4 per cent of variation in IQ among the study group was explained by the 4 variables, height, weight, mid upper arm circumference, chest circumference and head circumference. 'F' is also significant with a value of 6.48. Thus eventhough we cannot predict IQ with such small percentage of predictability, we can say that these 4 variable have a positive correlation with IQ (Table 64a) when both the experimental and the control groups are taken together.

Eventhough the regression coefficient was found to be non significant, the correlation coefficient was significant at 1 per cent level. This may be due to multicollinearity.

DISCUSSION

The present study was carried out to assess the nutritional status of ICDS and non ICDS preschool beneficiaries in Thrissur district and to assess the association, if any between nutritional status and level of intelligence. This chapter presents a discussion on the major findings of the study under the following sections.

1) Socio-economic background of the families
2) Food consumption and dietary pattern of the families
3) Details regarding the index child
4) Assessment of children by the class teacher
5) An appraisal of the ICDS programme implemented in the study area
6) Nutritional status of preschool children
7) Intelligence and its association with the nutritional status of preschool children

5.1 Socio-economic background of the families

Socio-economic status of the families emerges as one of the most important factors influencing the nutritional status of preschool children.

The above study indicated that majority of the families surveyed in the control group were found to be Hindus (81.43%), while christians and muslims were found to be a minority. In the experimental group half of the families (53.75%) were Hindus, while christians and muslims formed the rest. In both the groups majority of the families in Hindu religion belonged to backward communities.

In line with the findings of Ukkuru (1993), joint family system was prevailing in majority of the families (56.25%) surveyed in the experimental group and in contrast to this in the control group majority lived in nuclear families (57.14%).

Family size is a major factor influencing the development of children. Large families are more prone to having malnourished children, due to the inability of mothers to provide adequate care to their young children. Majority of the families in the study group were medium sized with 3-5 members.

Small family norm was maintained with 2 adults and 2 children in majority of the families. Shyna (1996) also reported similar findings among the preschool children of the agricultural labourers in Thrissur districts.

Illiteracy is a serious obstacle to the establishment of a social order based on equality. It withholds the development of an individual, society and the nation (CSR, 1997). Education plays an important role in determining how resources are being utilised to secure food, care and health for children (Varma *et al.*, 1996). Thus educational level of parents is a major factor which influences growth and development of children. The present study revealed that majority of the men (62.86%) and women (54.29%) in the control groups had high school education with a slightly better percentage of men (78.75%) and women (67.5%) in the experimental group. This result was supported by the Census of India (1991), which ranked Kerala as the most literate state. In the present study men were found to be more educated than women. This result was in contrast to the report of Shyna (1996) in which women were more educated than men and in tune with the results of Kamath (1989) in which the literacy level of female population was low.

A basic feature of our rural economy is that agriculture is the major source of employment and living. From the results it was found that majority of the male members of families in the experimental (62.5%) and control group (74.29%) were agricultural labourers and most of the mothers in both the experimental (85%) and control group (88.57%) were engaged in routine house work. Kamath (1989) also reported a similar finding in the NES blocks of Trivandrum.

Maternal age is one of the known contributory factors in the causation of malnutrition. The older (above 35 years) or younger (adolescents) the mother, the more likely is the child to be malnourished. However it was not the case in the present survey where most of the mothers were in the age group of 26-30 years.

Possession of land by an individual generally indicated his social status and security. In the present study, majority of the families in both the groups possessed land of their own ranging from 0-20 cents and majority of the families in both the groups were found to cultivate one or the other crop, coconut being the major crop.

The role of poverty in the aetiology of malnutrition is primarily a problem of poor countries and of the poorest section of the community within those countries. Income of the family thus definitely affects the nutritional status and development of the child (Tuncbilek *et al.*, 1996). In the present study income distribution was found to be almost same in both the groups with majority of both the group having an average income of Rs.1000-Rs.2500 per month.

The monthly expenditure pattern of the families revealed that a major share of the income (31-70%) was spent on food items by both the groups. It is in line with the study conducted by Moorthy *et al.* (1983). Devadas and Easwaran

(1986) and Rai and Sarup (1995), who found that 84, 90 and 62.15 per cent of the monthly income was spent on food by rural households in Hyderabad, Kerala and Tamil Nadu respectively. Usha *et al.* (1990) and Thomas (1989) also reported that economically poorer families spent major share of their income for food. Majority of the families in both the groups did not spend money for shelter, rent, personal expenses, entertainment and repayment of loans. Expenditure on clothing, transport, education, health and other expenses were substantially low (0-10%) among the families of both the experimental and the control group. A similar result was reported by Usha *et al.* (1990) and Jayanthakumari (1993) in studies among the farm families of Trivandrum district while Udaya (1996) reported the same in the farm families of Thrissur district.

It was found that majority of the families in the experimental (83.75%) and the control groups (85.71%) saved money for their future needs. Cherian (1992) and Jayanthakumari (1993) also reported similar results.

The ideal home environment for personality building is one in which the child is happy and friendly, for that he should be provided with better facilities (Hurlock, 1996). Home environment is one of the factors responsible for the intellectual development of children and hence home setting has a profound influence on the pattern of life of the child (Upadhyay and Agarwal, 1984).

In the present study it was encouraging to note that almost all the families in the experimental and the control groups possessed a house of their own which were tiled, built with brick and with 3-5 rooms. Majority of the families had basic amenities like separate kitchen, drinking water, lavatory facilities, electricity and recreational facilities. These findings are in line with the observations of Udaya (1996). Families in the experimental group (95%) were found to have drainage

facilities while only 8.57 per cent of the families in the control group had proper drainage facilities. This may be attributed to the effect of package of services of ICDS. It was also found that majority of the families in both the experimental (61.25%) and the control group (51.43%) do not possess any transport facility of their own. Thus it was found that the living conditions of the families of both the groups were found to be satisfactory and hence contributed to better family relationships.

5.2 Food consumption and dietary pattern of the families

Man must eat to live, and what he eats will affect in a high degree his ability to keep well to work to be happy and to live long (Robinson, 1996). Thus food is the major vehicle affecting improved nutrition of people and hence assessment of food consumption and dietary habits of the people should form an integral part of the evaluation of any nutrition intervention programme (Chavez, 1984).

Food consumption pattern of the families indicated that majority of the families in the experimental (97.5%) and the control group (94.29%) were habitually non-vegetarians.

The food expenditure pattern revealed that majority of the families in both the groups spent more money for the purchase of cereals. These findings are in line with the results of Jayanthakumari (1993). Majority of the families in both the groups spend up to 10 per cent of their income on pulses, other vegetables, fruits, milk and milk products, meat, fish, roots and tubers, nuts and oilseeds, spices and condiments and sugar and jaggery while majority of the families in both the groups did not spend any money for the purchase of fats and oils.

The frequency scores revealed that the most frequently used food items by both the experimental and control groups were cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oilseeds, spices and condiment and sugar and jaggery. These results are partly in tune with the results revealed by Udaya (1996) and Augustine (1993). In the experimental group fruits and egg and in the control group green leafy vegetables, fruits and egg were the medium frequently used foods. This is in contrast to the findings of Udaya (1996) and Lina and Reddy (1989) who reported that the dietary pattern of the Keralites was based upon an excess consumption of tapioca and fish.

Cooking of the food is the use of heat to bring about desirable changes in foods being consumed. The nutrition of the individual is profoundly influenced by the quality of the food preparation (Manay and Shadaksharaswamy, 1987). The way in which food is cooked influence the retention of nutrients in foods. Majority of the families adopted the boiling method for almost all food stuff. Cherian (1992) and Udaya (1996) also observed similar practice.

Special foods given during different physiological conditions revealed that majority of the families in both groups were found to take much care during infancy. Foods like ragi powder, banana powder, bulghar wheat, ready to buy infant feed formulas etc. were included as supplementary foods by majority of the families. Similar practices were reported by Jayanthakumari (1993) and Udaya (1996).

Majority of preschool children in India received only ordinary home diets and those diets were deficient in many nutrients especially in vitamins and minerals (Bhat and Dahiya, 1985). Similar trend was observed in this study in the case of preschoolers, school going children and adolescents of both the groups. Majority of

the pregnant women in the experimental group were found to take milk and fruits in their daily diet. This may be due to the influence of nutrition messages disseminated through health education classes of ICDS. This was in contrast to the findings of Goswami (1989), Usha *et al.* (1990), Shyna (1996) and Udaya (1996) who reported that no special foods were given to pregnant women, like in the case of pregnant women in the control group of the present study.

During diseased conditions certain modifications in the diet are necessary and it was found that all the families in both the groups avoided solid foods and used to give liquid foods like rice gruel.

5.3 Details regarding the index child

The pattern of development can be interfered with, either temporarily or permanently, by environmental or physical conditions. So to assess the potential intellectual abilities of the child, these aspects must be taken into consideration. Of the 150 preschool children selected for the study, there was an equal distribution of 35 girls and 35 boys, in the non ICDS group (control group) and an equal apportion of 40 girls and 40 boys in the ICDS group (experimental group).

Increasing birth order is associated with an increase in the percentage of undernourished due to the fact that as the number of children increases, the time allocated for child rearing decreases for an individual child. In the present study most of the children in both the control and the experimental group (51.43 and 50% respectively) were of the first order.

Birth weight of a child is the fundamental basis on which one yields an accurate picture about his pre-natal nutritional level and his developmental pattern.

The present study indicated that majority of the preschool children in both the groups had birth weights ranging from 2.5 kg to 3.5 kg. However in the experimental group, the percentage of children who had birth weights above 3.5 kgs was found to be greater that the control and the percentage of children belonging to the low birth weight category was found to be less in the experimental group than the control group. This may be due to the efficient and effective participation of mothers of the ICDS beneficiaries in the supplementary nutrition and nutrition and health education components of ICDS programme.

Immunisation is being implemented all over the country to prevent major communicable diseases. It contributed significantly to the reduction of disabilities and mortality and morbidity rates of children. In the developing countries, the lives of almost 20 lakhs of children are saved by the administration of vaccines and those children who play around normally would have been affected by polio, if the immunisation practices of the 1990's were not undertaken. Immunization status of the preschool children in this study presents a very lucid picture concerning the beneficial effects of ICDS because of the higher percentage of completely immunised children in the experimental group and higher percentage of partially immunized children in the control group.

(Well educated parents are able to provide better care in comparison to less educated parents. It may be due to the fact that educated parents have knowledge about health care practices like immunization. This study also revealed that parents educational level had a positive influence on immunisation status of the children as majority of the parents who are educated above high school level had given compelete immunization to their children. The findings of Shyna (1996) partly supported the above statement. Morbidity pattern of this children in the study ascertained the beneficial effects of ICDS because of the higher percentage

(96.25%) of children in the ICDS group, who were not affected by any epidemics. This may be due to the impact of the immunisation component of the ICDS package of services.

'All work and no play makes Jack a dull boy' an old saying points out the importance of play in a child's personality development and it was found that in this study all the children in both the groups had their own play materials.

Majority of children in the control group had text books for learning and for acquiring additional knowledge, thus depriving them of an opportunity to play. Taxing them with work activities like this is hazardous to good personal and social adjustment as compared to the anganwadi centre where the teacher used more audio-visual aids and other play materials for teaching, which provided children with more enjoyment and stimulation.

The time taken and the distance covered to reach the school may indirectly influence the learning capacity of the children. According to Kamath (1989) hungry and tired children are inattentive and irritable in classrooms. The results of the present study revealed that more than 90 per cent of the children of both the groups were not affected by this since they were residing within a radius of one kilometer from school and reached the school in 15 minutes.

According to DHS (1991), Cohen (1993) and Choksi (1995), if the nutritional foundations are not provided adequately to the child during his early years, it will affect his overall development. In the present study the percentage of children admitted to the anganwadi before 4 years of age were found to be higher (91.25%).

Anganwadi and balwadi centres are places where food is distributed to the vulnerable population of the community. The food eventhough nutritious, if not prepared hygienically in clean premises could cause hazards. Similarly AWC/BWC are places where young children are found to remain for more than 5 hours. Moreover AWC is a place where the package of practices are extended and especially health check up are conducted by the health personnels. All these factors stress the importance of cleanliness at the centres and its premises, since it acts as a major factor influencing the participation level. In the present survey, all the mothers in both the groups had a highly favourable opinion with regard to the cleanliness of the the AWC/BWC and its premises.

Sanitary conditions in which man lives is one of the public health measures effective in the improvement of nutrition. In poor environmental and personal hygiene and poor sanitations, disease may fluorish. Majority of children in both the groups took bath daily and changed their clothes twice a day.

Details regarding the deworming of children provides a better picture of the ICDS because of the higher percentage of the families in the experimental group who dewormed their children every 6 months. This may be due to the influence of the health education component of the ICDS.

The adjustments the child make to new demands and new environment conditions pressures him to express various behavioural problems. During phases of disequilibrium, a constellation of environmental pressures and biological changes affects the child's behaviour. Children may cling to immature behaviour because they have not yet learned to meet their needs in a more mature manner. Children's day-to-day behaviour is also related to chronic and acute malnutrition, and this behaviour probably correlates with effective learning. An assessment of behavioural

problems of the children indicated that the percentage of children exhibiting various behavioural problems was reported to be less in the experimental group, compared to the control group. This may be due to the better stimulation given to the child in the anganwadi.

5.4 Assessment of children by the class teachers

Results of the assessment by class teacher indicated that despite some negative behavioural patterns exhibited by some children in both the groups, almost all the children in the experimental as well as control groups were found to be friendly towards their classmates.

Development refers to qualitative change, that is, increase in skill and functions viz., intellectual, emotional and social aspects. The intellectual performance of the children as assessed by the teacher by noting childrens reasoning capacity, attention span, memory power, imagination and creativity and over all performance at school. The results again revealed the excellence of the experimental group over the control group by grouping a small percentage (6%) of children in the below average and a higher percentage in the average intellectual performance group, compared to the control group, who had a higher percentage of children in the below average group. The reason for this better intellectual performance of children of the ICDS group may be due to the nutritious food and the cognitive stimulation given to the child at the centre.

Inspite of certain negative behaviour patterns of the children in the class room, when the teacher analysed the social behaviour pattern, majority of preschool children in both the groups were found to have pleasing social behavioural patterns. It was also found that almost all the children liked group play rather than solitary

play. It was found that eventhough many children in the control group had some artistic talents, only a few of them exhibited their talents by participating in extra curricular activities, while all the children in the experimental group who had some artistic talents expressed their abilities through various extracurricular activities. This again proves the better stimulation given to the children by the anganwadi workers.

5.5 An appraisal of the ICDS programme implemented in the study area

An appraisal of the ICDS programme implemented in the study area will provide valuable information pertaining to the programme performance and its resource utilisation.

It was found that supplementary nutrition, nutrition and health education for mothers and non formal preschool education were found to be the persuading factors for participation in the experimental group, while in the case of control group it was non formal preschool education. It was found that all the children in the group were regular participants and majority of the mothers (72.5%) were beneficiaries of the ICDS while carrying the index child.

On assessing the food distribution system followed in the anganwadi, it was found that all the respondents followed and preferred `on the spot' feeding programme. The reason for the preference is that the child will relish and have the food completly when he/she have it along with their peers. Almost all the children in the anganwadi relished the food served and were found to be content with the quality and quantity of the food and it was found that the food supplement (CSB) was highly nutritious.

The anganwadi food ie. Corn Soya Blend (CSB) was served in the form of uppuma and was served at 3 pm in the evening which was suitable for everyone.

Regarding the facilities available at the AWC/BWC it was found that all the facilities were available except building and furniture.

5.6 Nutritional status of the children

In the present study, actual food and nutrient intake, anthropometry, biochemical estimations and clinical examinations were reckoned as the major determinants of nutritional status of the preschool children.

5.6.1 Actual food and nutrient intake of selected preschool children (subsample)

Assessment of the actual food intake of the respondents of the experimental and the control group revealed that cereal consumption was inadequate in the diets of both the groups ie. only 46.57 and 45.55 per cent of the R.D.A. was met in the experimental and the control group respectively. These findings are in line with the studies of NNMB (1995) and Udaya (1996). Pulse consumption of the preschool children ranged from 69.9 per cent of the RDA in the experimental group to 62.9 per cent of the RDA in the control group and that was also lower than that suggested for balanced diets. The intake of leafy vegetables was far from satisfactory. NNMB (1981) and NNMB (1995) confirmed the above finding. Though the green leafy vegetable consumption was poor in the experimental group, it was better when compared to the control group. The intake of other vegetables were close to the RDA in the case of experimental group and it was higher than the RDA in the control group. Consumption of fruits and milk and milk products was close to the RDA in the experimental group while it was much

lower than the recommended intake in the case of the respondents of the control group. The intake of roots and tubers and protein rich foods like meat, fish and egg were found to be well above this suggested amount in both the groups. In both the groups the fat and oil and sugar and jaggery intake was found to be deficient by 50 and 80 per cent respectively.

Mean nutrient intake of preschool children revealed that energy intake was not sufficient in the diet of the children of the experimental and the control groups, the deficiency being much lower in the control group and that shows a caloric gap in the food intake. Pinstrip *et al.* (1991); ICMR (1994) and Udaya (1996) also observed a reduced energy consumption among the households of India. Brahman *et al.* (1988); Gopalan (1989) and Shyna (1996) also stated that there is a calorie gap in the dietaries of the preschool children. In contrast to the energy intake, protein intake was adequate and well above the recommended allowance in the diets of both the groups. Consumption of iron revealed that iron intake was sufficient in the children of the experimental group. While it was very low (45% of the RDA) in the control group. This is in contrast to that revealed by Singh *et al.* (1993) and NNMB (1995) in their studies on rural preschool children that these children suffered from iron deficiency basically due to inadequate cereal based food items.

The mean intake of all the other nutrients namely, ß-carotene, thiamin, riboflavin, niacin and vitamin-C by children of the experimental group were found to be either very close to or well above the recommended daily intake. In contrast to this Shyna (1996) and Udaya (1996), in their studies conducted in Thrissur district reported that the intake of all the above mentioned nutrients were found to be far below the recommended levels and in line with this, in the present study, the intake of ß-carotene, B-complex vitamins and vitamin-C be were below than that

suggested for balanced diet in the case of the children belonging to the control group.

When statistically analysed it was found that nutrient intake of the experimental group was significantly better than the nutrient intake of the control group. This may be due to the consumption of the corn soya blend (CSB), the supplement provided in the AWC which is highly nutritious, by the ICDS beneficiaries. This is again confirmed by the nutrient contribution from the meals, of the experimental group, which revealed that the major source of all the nutrients were from the evening tea during which the food supplement CSB is supplied.

5.6.2 Anthropometric measurement of preschool children

Anthropometric measurements such as height, weight, head circumference, chest circumference and mid upper arm circumference were considered as the best tool for detecting various degrees of growth retardation among the population, because even before clinical illness manifests, the growth pattern provides information regarding changes in the nutritional status. It also ascertains the impact of various nutrition intervention programmes, since it yields simple data which constitute measurable and hence objective criteria for evaluation.

For the interpretation of the anthropometric data it has to be compared with standards. Anthropometric standards developed by ICMR (1994) is used in the present study for comparison as national standard whereas anthropometric standards developed by National centre for Health statistics U.S.A. (NCHS), as international reference standard which was recommended by the WHO expert group (1987).

Height for age profile of the children, which is a measure of past nutritional status of the subject, indicated that both the experimental and the control groups was not significantly different and had not maintained either ICMR or NCHS standards. Meetakumari *et al.* (1988) and Ukkuru (1993) also found that mean height measurement of the experimental and the control groups of children belonging to the ICDS project was not significantly different.

Height for age of the preschool children was compared with the Indian and International standards based on different grades of malnutrition suggested by various authors. As per the classification suggested by Mclaren, for stature of the children, when compared to ICMR standards, more than 60 per cent of the boys and girls in the experimental and the control group, was found to have normal stature. When compared with NCHS standards, more than 75 per cent of the girls and 60 per cent of the boys in both the experimental and the control groups belonged to the normal group.

According to Waterlow's classification using the same Indian and International standards, when compared to ICMR standards, around 50 per cent of the children in both the groups belonged to the normal category. According to NCHS standards, 49 per cent of the children in experimental group belonged to the normal group while 43 per cent of children in the control had marginal retardation.

When interpreted according to Vishveshwara Rao's classification using the same ICMR and NCHS standards, majority of boys and girls in both the groups belonged to the normal group. The percentage of normal statured children belonging to the experimental group was higher than the control group as per both the standards.

In all the above classifications, as per the NCHS standards, more girls were found to have normal height for age when compared to boys.

While height for age is an indicator of past nutritional status, according to Gopaldas and Seshadri (1987) and Narin (1992), weight for age is effectively used an index to determine the current state of nutritional status of children. Weight for age was compared with the Indian (ICMR) and International (NCHS) standards based on different grades of malnutrition given by Gomez and Indian Academy of Pediatrics (IAP).

Classification of children based on different grades of malnutrition as suggested by Gomez using ICMR standards revealed that only around 25 per cent of children in both the groups had normal weight for age, while 55 per cent and 20 per cent of children in both the groups had Grade I and Grade II malnutrition respectively. As per NCHS standards almost a same trend was observed, while 2.86 per cent of children in the control group had Grade III malnutrition.

Distribution of children according to different grades of malnutrition corresponding to IAP showed that, when compared with ICMR standards, majority of children (68%) in both the groups belonged to the normal group. As per NCHS standards, 56.26 per cent of the children in the experimental group had normal weight for age while only 45.71 per cent of the children in the control group had normal weight for age and 2.86 per cent of children in the control group belonged to Grade III malnutrition.

Comparison of weight/height^2 ratio with the classification of Rao and Singh for various grades of malnutrition revealed that majority of the children in

both the experimental and the control groups (82.5 and 80% respectively) were having moderate malnutrition.

From the above findings it can be concluded that there was no incidence of severe grades of malnutrition among preschool children. This is in line with the results obtained by NNMB studies in Kerala (1995) that the preschoolers of the slums of Trivandrum had better dietary intake and also the lowest proportion of undernourished children (severe and moderate degree).

The head and chest circumference ratio helps to identify the normal and malnourished children. The mean values of the head and chest circumference when compared with the Indian standard (NFI), there was no significant difference from the standard values. When head circumference:chest circumference ratio was compared according to the classification given by Tara Gopaldas, more than 85 per cent of the children in both the experimental and control groups were in the normal group. Analysis of variance showed that the head circumference and the chest circumference of children belonging to the experimental group were found to be significantly better than the control group. The head and chest circumference had high F values of 4.874 and 5.320 respectively.

Mid Upper Arm Circumference (MUAC) is used as an indicator for screening the severely malnourished children. The mean mid upper arm circumference of children of both the groups when compared with NFI standards, there was no significant deviation from the standard values. When the MUAC values of these children were distributed according to different grades of malnutrition suggested by Tara Gopaldas, it was found that almost all the children (98.75 and 97.14% in the experimental and the control group respectively)

belonged to the normal category. There was no significant difference between the MUAC of the experimental and the control groups.

5.6.3 Biochemical profile of the selected preschool children

Agarwal (1991) had reported that nutritional anaemia is characterised by inadequate erythropoisis and reduced haemoglobin concentration which is due to inadequate supply of nutrients like iron, folic acid and vitamin-B_{12}. The biochemical estimations conducted among the subsamples to assess the haemoglobin level indicated that 75 per cent of the children in the experimental group had acceptable levels of haemoglobin while 85.71 per cent in the control group had deficient haemoglobin level. This may be attributed to the better intake of nutrients especially iron by the experimental group, which is derived mainly from the food supplement CSB supplied in the anganwadi. This is in tune with the findings of Ukkuru (1993).

5.6.4 Clinical assessment of the selected preschool children

Clinical examination is the most effective measure to find out the nutritional deficiencies among individuals. The results of the present study indicated that, while no clinical manifestations were present among the preschool children belonging to the experimental group, there was a wide prevalence of anaemia and a mild prevalence of teeth caries among the control group. This is again attributed to the intake of the food supplement provided in the anganwadi, which provides all the required nutrients in balanced amounts.

When nutritional status of the children which is believed to reflect community's nutritional status was considered, preschool children of the experimental group had better dietary intake, lowest proportion of under nourished

children better haemoglobin level and absence of clinical signs of nutritional deficiencies, which is assumed due to the impact of the ICDS programme. Thakur *et al.* (1989), Vivek *et al.* (1989), Sarma *et al.* (1990) and Ukkuru (1993) also reported a similar finding in their studies.

5.7 Intelligence and its association with nutritional status of preschool children

An IQ is not immutable, it just shows the current capacity of the child or the potential of the child in current conditions. Malnutrition was found to have a definite impact on the intelligence of children, the degree of malnutrition being related to their intellectual functioning. In the present study intelligence quotient (IQ) of the children were assessed by using Mathew's Test of Mental Abilities and it was found that the intelligence score of the children belonging to the experimental group was significantly better when compared to that of the control group. Majority of the children in the experimental group belonged to the average and above average intelligence levels with 8.75 per cent of the children belonging to the very superior group, while in the control group majority belonged to the borderline and average group with only 1.43 per cent in the very superior group. When statistically analysed, the IQ of the experimental group was significantly better than the control group.

Intelligence and its relation to nutritional status with regard to nutrient intake and anthropometric measurements were statistically analysed.

When multiple linear regression of IQ on energy, protein, iron and ß-carotene was done separately for the experimental and control groups, the relationship was not significant. However, the regression was significant and 62.1 per cent of the variation in IQ was explained by the regression when both the

groups were pooled. This could be because of the homogeneity of subjects within each group and the increased heterogeneity in the combined group.

IQ and its relation to different grades of growth gradation were analysed and discussed below.

Weight/height^2 ratio was compred with the IQ of the children and it was found that majority of children in both the groups belonged to the moderately malnourished group. Among this, in the experimental group majority was found to have an average IQ, while in the control group majority belonged to the borderline IQ level. The rest in the experimental group had IQ levels ranging from bright to very superior, while in the control group, the rest belonged mainly to the average level. Among the normal statured children in the experimental and the control group the IQ was found to be average and above. Among undernourished children in both the groups the IQ was found to be low. Similar trend was seen in the study of Shyna (1996). Usha *et al.* (1973) also reported a close relationship between IQ, height and weight.

When head circumference:chest circumference ratio was compared with the IQ of preschool children, it was found that majority of the properly nourished children in the experimental group had IQ ranging from average to very superior while in the control group majority of the normal children belonged to the borderline and average IQ groups. In the case of malnourished children, in the experimental group majority had average and bright IQ while in the control group majority had only borderline IQ. This finding was in line with the findings of Shyna (1996).

IQ was studied in relation to the mid upper arm circumference of the children and it was found that majority of the children in both the groups belonged to the properly nourished category and in the experimental group majority of the properly nourished children had IQ's ranging from average to the very superior levels, while in the control group majority of the normal children had borderline and average IQ levels. This finding also was in tune with the results of the study conducted by Shyna (1996) among the preschool children of the agricultural labourers in Thrissur district.

Multiple linear regression of IQ on anthropometric measurements viz., height, weight, mid upper arm circumference, chest circumference and head circumference, was done separately for experimental and control groups, the regression was not significant. But when both groups are pooled, the regression was significant and 18.4 per cent of variation in IQ was explained by the regression involving the measurements. This results are in tune with the findings of Choudhry (1984), Kamath (1989) and Shyna (1996).

As in the case of nutrients, here also the two groups could be more homogenous and hence the regression was not able to assess the influence of anthropometric measurements on IQ, when the groups were considered separately. But the combined group had significant variability in the characters considered and that must be the reason for a significant regression for the combined group.

Eventhough 62.1 per cent and 18.4 per cent variation in IQ of the children belonging to both the ICDS and non-ICDS groups were explained by the nutrient intake and anthropometric measurements respectively, it can be concluded from all the other findings that ICDS has got a positive impact on the nutritional status of its preschool beneficiaries. This may be due to the fact that the impact of a

programme on its beneficiaries will depend upon the nature of the intervention programme and the positive effect will appear only after one or two years as reported by Ukkuru (1993).

Summary

SUMMARY

The present study entitled "Nutritional status and Intelligence of pre-school beneficiaries of ICDS and non-beneficiaries of Thrissur district was carried out, selecting 80 respondents from 8 ICDS blocks (experimental group) and 70 respondents form 7 non ICDS blocks (control group).

The study apprised the socio-economic back ground, food consumption and dietary pattern of the families, details regarding the index child, nutritional status of the children through actual food and nutrient intake, anthropometric, biochemical parameters and clinical assessment and the intelligence and the association between intelligence and nutritional status.

Majority of the families in the experimental group were of joint type while in the control group majority were of nuclear type with the average family size ranging from 3-5 in both the groups.

Majority of parents were having high school education. The experimental group had better educated parents compared to the non ICDS group. Most of the families were engaged as agricultural labourers and had a monthly income ranging from Rs.1001 to 2500/-.

Major family expenditure was for food followed by transport, health and education.

Housing conditions and living facilities of the families of both the groups were found to be satisfactory.

All the families were habitual non-vegetarians and their staple food was rice. Most of the families in spent more money for cereals and cereals, pulses, other vegetables, milk and milk products, fish, fats and oils, nuts and oil seeds, spices and condiments and sugar and jaggery were the most frequently used foods. Consumption of protective foods like green leafy vegetables was substantially low in both the ICDS and non ICDS groups. Most of the families adopted boiling methods for cooking foods. Special foods were given only during infancy in both the groups.

Details regarding the index child revealed that majority of the children were in the first birth order, had birth weights above 2.5 kgs and completely immunised, with the experimental group performing better than the control group. Morbidity and mortality pattern was also found to be very low in all these children. Children in both the groups had their own play materials and lived within a radius of one kilometre from the school. Majority of the children in both the groups were admitted to the school before 4 years of age.

An appraisal of the ICDS programme implemented in the study area revealed that supplementary nutrition, non formal pre-school education and nutrition and health education for mothers were the major persuading factors for participation among the ICDS group. The respondent considered the supplementary food served in the AWC i.e., corn soya blend (CSB) served in the form of uppuma nutritious, sufficient and relishable. On the spot feeding was followed in all the anganwadies. All the AWC and BWC had all the other amenities except building and furniture facilities.

Children belonging to both groups exhibited cleanlines and majority were dewormed every 6 months, the percentage being higher in the ICDS group.

Behavioural problems like nail biting, sibling rivalry, rebelliousness towards elders were found to be less among the ICDS beneficiaries compared to their non ICDS counterparts. The assessment of class teacher revealed that almost all the children were friendly towards their classmates when the intellectual performance of the children were analysed it was found that majority of the ICDS beneficiaries belonged to the average category while majority in the non ICDS group belonged to the below average group. Both the groups exhibited pleasing social behavioural patterns.

In depth investigation on selected respondents of the two groups for assessing the actual food and nutrient intake revealed that all the food groups except other vegetables, roots and tubers, fleshy foods and milk and milk products included in the daily diet of both the groups was far below the Recommended Dietary Allowance. Regarding the nutrient intake, the nutrient intake by the ICDS beneficiaries was found to be on par with the RDA, except for energy. While in the non ICDS group the protein requirement alone was met as per the RDA. The nutrient intake of the ICDS group was found to be significantly better than the non ICDS group. This must be due to the intake of the highly nutritious food supplement, `corn soya blend' (CSB) provided from the anganwadi.

The anthropometric profile of pre-school children was interpreted by comparing with ICMR and NCHS standards. Eventhough the mean height and weight was not onn par with the standard values the values of both the groups does not differ significantly. As per the weight/height^2 ratio majority of the children in both the groups belonged to the moderately malnourished group. As per the Vishveswara rao classification for height for age and IAP classification for weight for age, the height and weight of a higher per cent of ICDS beneficiaries were found to be normal. The head circumference and chest circumference were also

found to be better in ICDS groups compared to the non ICDS group. Thus from the above findings it can be concluded that there was no incidence of severe grades of malnutrition among the pre-school children of both the ICDS beneficiaries and non-beneficiaries.

Biochemical investigations revealed that haemoglobin levels of the experimental group was significantly higher than the control group.

ICDS beneficiaries were found to be free from any form of clinical symptoms, while the non ICDS group exhibited anaemia and tooth caries.

Intelligence quotient of pre-school children of both the groups were tested and it was found that the IQ of the ICDS beneficiaries was significantly better than the non ICDS group with a majority in the ICDS category belonging to the average and above average IQ levels. While majority in the control group had borderline and average intelligence levels.

When both the groups were pooled and analysed 62.1 per cent variation in IQ was explained by the intake of the nutrients.

When weight/height^2 ratio was compared with the IQ of the children it was found that of the majority of the children belonging to the moderately malnourished group majority in the experimental group had average and above average IQ levels while majority in the control group belonged to the borderline IQ group. In both the groups among normal children IQ was found to be average and above and below average among the undernourished children.

IQ and its relation to different grades of growth retardation were statistically analysed and the regression was not significant. But when both the groups are pooled, the regression was significant and 18.4 per cent of variation in IQ was explained by the regression involving the anthropometric measurements.

Therefore from the results of the study it can be concluded nutritional status had a strong influence on the IQ of the children.

Eventhough the IQ, nutrient intake, biochemical parameters and clinical status of the ICDS beneficiaries were found to be significantly better than the non ICDS group, no correlation was found between IQ and nutritional status when both the groups were statistically analysed.

This may be due to the fact that the positive impact of an intervention programme on it's beneficiaries will appear only after one or two years. Thus we can conclude from all the above findings that there was some relationship between the nutritional status and intelligence among the ICDS beneficiaries.

Suggestions for improvement:

1. Motivation of mothers for the early admission of children in the AWC/BWC.
2. Incorporation of more vegetables in the food supplement by maintaining a vegetable garden in AWC and BWC.

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Appendices

APPENDIX - I

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF HORTICULTURE

Department of Home Science

Interview schedule to elicit information on socio-economic and personal characteristics of the selected ICDS and non-ICDS pre-school beneficiaries in Thrissur district

No:

Date:

1. Name of the Project :
2. Name of the Anganwadi/Balwadi :
3. Anganwadi No./Balwadi No. :
4. Name of the child :
5. Address :
6. Religion :
7. Caste :
8. Age of the child : _____ yrs _____ months
9. Type of family : Nuclear/Joint
10. Family pattern

Sl. No.	Relationship with the child	Sex	Age	Education						Occupation	Income
				Illiterate	L.P.	U.P.	H.S.	Graduate	P.G.		

11. Possession of land : Yes/No

    a) Area of land :

12. Details regarding cultivation of food crops

Sl. No.	Name of the crop	Area under cultivation	Total produce per year	Qty. used at home	Qty. sold	Income

13. Possession of livestock : Yes/No

a) If yes, what are they

Item	Number

b) Details of produce from domestic animals

Sl. No.	Name of the product	Qty. produced per month	Qty. used at home	Qty. sold	Income from produce Rs.

14. Source of income of the family

Sources	Amount
1. Agriculture	
2. Cattle wealth	
3. Poultry	
4. Govt. job	
5. Private job	
6. Business	
7. Coolie	
8. Others	
i.	
ii.	
iii.	
Total	

15. Monthly expenditure pattern

No.	Items	Expenditure Rs.
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	
	Total	

16. Details of housing conditions

i. Type of house

a) Own Rented
b) No. of rooms One / Two / 3-5 / 6-8 / 8 and more
c) Tiled/Thatched/Terraced
d) Mud/built/Brick built

17. Other characteristics

a) Source of drinking water	: Own well/public tap/public well/tank/ river
b) Lavatory facilities	: Own latrine/public latrine/open field
c) Separate kitchen	: Yes/No
Drainage facilities	: Yes/No
Electricity facilities	: Yes/No
d) Transport facilities	: Yes/No
If yes, specify	:
e) Recreational facilities	: Yes/No
If yes, specify	:

18. Social participation

a) Are you a member of any organisation/institution	: Yes/No
b) If yes, whether	: Active/Occassional
c) Specify	: 1. Mahila Samajam 2. Co-operative Society 3. Youth club 4. Panchayat Raj 5. Others

APPENDIX - II

Interview schedule to elicit information on the food consumption and dietary pattern of the selected ICDS and non-ICDS pre-school beneficiaries in Thrissur district

No:

Date:

1. Name of the Project :
2. Name of the Anganwadi/Balwadi :
3. Anganwadi No./Balwadi No. :
4. Name of the child :

5a. Dietary habit of the family : Vegetarian/Non-vegetarian

b. Dietary habit of the child : Vegetarian/Non-vegetarian

6. Food purchasing habit of the family

Items	Qty. purchased	Frequency of purchase			Amount spend Rs.
		Daily	Weekly	Monthly	
Cereals					
Pulses					
Green leafy vegetables					
Roots and tubers					
Other vegetables					
Fruits					
Milk and milk products					
Fleshy foods					
Nuts and oilseeds					
Spices and condiments					
Others					

7. Frequency of use of different food materials

	Frequency of use					
	Daily	Weekly			Occasionally	Never
		Once	Twice	Thrice	Four times	
Cereals						
Pulses						
Green leafy vegetables						
Roots and tubers						
Other vegetables						
Fruits						
Milk and milk products						
Meat						
Fish						
Egg						
Fats and oils						
Sugar and jaggery						
Bakery items						

8. Different methods of cooking

Foods	Boilding		Steaming	Frying	Baking	Shallow frying	Any others
	Absor-ption	Strain-ing					
Cereals							
Pulses							
Green leafy vegetables							
Roots & tubers							
Other vegetables							
Meat							
Fish							
Egg							
Milk and milk products							
Baked items							

9. Foods during special conditions

Condition	Foods given	Reason	Foods avoided	Reason
Infancy				
Pre-school period				
School going children				
Adolescent				
Pregnancy				
Lactation				

10. Dietary modification during the diseased conditions

Name of the disease	Alternations made

APPENDIX - III

Interview schedule to elicit information on health and behavioural pattern of the index child as assessed by the mother

No:

Date:

1. Name of the Project	:	
2. Name of the Anganwadi/Balwadi	:	
3. Anganwadi No./Balwadi No.	:	
4. Name of the child	:	
5. No. of children	:	Birth order Age
		1.
		2.
		3.
		4.
		5.
6. Birth order of index child	:	
7. Birth weight of index child	:	
8. Did any child die? If yes,	:	Yes/No
Reason for death	:	1 / 2 / 3 / 4 / 5
9. Immunisation details of the index	:	Complete/Partial/Not taken
10. i) Does the index child got any serious illnes after birth	:	Yes/No
ii) What type of illness	:	
11. Does it occur frequently	:	Yes/No

12. Morbidity pattern of index child . Details of epidemic that had affected the index child during the past one year

Diseases	Duration	Treatments

13. Facilities available to the child at home:

Does the child has own room : Yes/No
Does the child have play materials : Yes/No
(specify the play materials - outdoor, indoor)
Does the child has text book for learning : Yes/No
Does the child have other books for learning : Yes/No

14. Distance between anganwadi/school and home

Distance between AWC/School and home				Mode of transport	Time taken			
Within ½ KM	Within 1 KM	Within 2 KM	More than 2 KM		>15 min	>½ hr	> 1 hr	<1 hr

15. Details of admission of the child in the Anganwadi

Less than 1 year	1-2 years	2-3 years	3-4 years	4-5 years	5-6 years

16a. Are you satisfied with the cleanliness of the centre and premises:

Centre : Yes/No
Premises : Yes/No

b. If no, give reasons

1.
2.

17. How often does the child change his/her clothes in a day? : Once/Twice/Thrice/Four times

18a. Does the child takes bath daily? : Yes/No

b. If no, how often? : Once in 2 days/Once in 3 days

19a. Do you deworm the child every 6 months? : Yes/No

b. If no, why? :

c. Medicine do you use? :

20. Behavioural problems of the children

Behavioural problems	Yes	No
1. Nail biting		
2. Bed wetting		
3. Thumb sucking		
4. Day dreaming		
5. Sibling rivalry		
6. Depression		
7. Rebellious towards elders		
8. Speech difficulty		
9. Lethargic		
10. Irregularity in studies		
11. Playfulness		
12. Quarrelsome		
13. Saying lies		
14. Kleptomania		

APPENDIX-IV

Interview schedule to elicit information on general performance of the children in school as assessed by the teacher

No:

Date:

1. Name of the Project :
2. Name of the Anganwadi/Balwadi :
3. Anganwadi No./Balwadi No. :
4. Name of the child :
5. Behaviour of the child in class :

Fishing with friends	:	Yes/No
Rebellious towards teacher	:	
Constant fear	:	
Jealousy towards classmates	:	
Revengeful towards classmates	:	
Friendly towards classmates	:	

6. Intellectual development

	Below average	Average	Above average
a. Reasoning capacity			
b. Attention span			
c. Memory			
d. Imagination and creativity			
e. Performance of school			

7. Social development : Yes/No
   a. Talkative
   b. Calm and quiet
   c. Co-operative
   d. Is the child popular in school
   e. Is the character and conduct of the child is good
   f. Is the child willing to share his belongings with others
   g. Does the child has friends
   h. Type of play liked by the child : Group play/Solitary play

8. Participation in extracurricular activities

Does the child has artistic talents	: Yes/No
Does the child participate in extra curricular activities	: Yes/No

APPENDIX-V

Interview schedule to evaluate the ICDS programme implemented in the study area

No:

Date:

1. Name of the ICDS Project :
2. Name of the Anganwadi/Balwadi :
3. Anganwadi No. :
4. Name of the child :
5. Give details of the service you availed from the centre for the past 6 months service

Sl.No.	Services	No. of times offered	Participation
1	Supplementary nutrition		
2	Immunisation		
3	Health check up		
4	Health education		
5	Pre-primary		
6	Referral services		

6. What is the provision for sending the child to this Anganwadi :
7. Is the child regularly sent to the Anganwadi : Yes/No
   If no, give reasons
8. Is the child sent to any other Balwadi/ Pre-KG before enrolling in the Anganwadi : Yes/No
9. Were you a beneficiary of the ICDS when you were carrying the child : Yes/No
10. What is the food distribution system followed in the AWC?

10. What is the food distribution system followed in the AWC?

1. Consume at the AWC : Yes/No
2. Somebody carried cooked food/ raw food home for the index child

a. Which of the above system of distribution do you prefer for your child?

b. Why?

1.
2.

11. Does the child take the food supplement served in the Anganwadi? : Yes/No

12. The reason for taking food supplement

1.
2.
3.

13. Opinion about the food supplement : Good/Bad

14. Opinion about quantity of the food supplement : More than sufficient/sufficient/ insufficient

15. Does the child relish the food supplement fully? : Yes/No

16. Furnish the details regarding the food supplement served in the Anganwadi

Sl.No.	Type of food	Qty. consumed	Time of serving

17. Facilities available at AWC/BWC

Facilities	Fully available	Partially available
Safe drinking water		
Environmental hygiene		
Building facility		
Toilet facility		
Facilities for play		
Sleeping facilities		
Facility for preparing food		
Furniture facility		

APPENDIX-VI

Procedure followed for taking anthropometric measurements

1. Weight

The weight was measured using a platform balance, as it is portable and convenient to use in the field. The weighing balance was checked periodically for accuracy. The scale was adjusted to zero before each measurement. The subject was weighed with minimum clothing. The child was made to stand on the centre of the platform without touching anything, and looking straight. Care was taken to use the balance on a firm surface. The weight was recorded to the nearest 0.25 kg. Each reading was taken twice to ensure correctness of the measurement.

2. Height

To measure the height, a measuring tape was used. The tape was placed perpendicular to the ground, taking care to see that the floor area was even and not rough. The subject was asked to remove the slippers, and made to stand with the centre of her back touching the scale with her feet paralled and heels buttocks, shoulders and back of the head touching the tape. The head was held comfortably, erect, the arms hanging loosely by the side. The ruler was held on the top of the head in the centre crushing the hair at right angle to the scale and height was read off from the lower edge of the ruler to the nearest 0.5 cm. Each reading was taken twice to ensure correctness of the measurement.

3. Mid upper arm circumference

Mid upper arm circumference was measured with the help of a flexible measuring tape. The child was asked to flex his left arm at the elbow so that the lower arm was at right angle to the upper arm, and the length between the acromion

process of scapula and olecranon process of ulna was measured. The mid point of this measurement was found out and was marked with a pen. The subject was asked to hang his arm and the measurement was taken to the nearest 0.1 cm by placing the tape gently but firmly around the selected mid point.

4. Head circumference

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

5. Chest circumference

The flexible, non-strechable fibre glass tape was used to measure the chest of the child at nipple line. The average of the inspired and expired chest measurement to the nearest 0.1 cm was taken as the chest measurement.

APPENDIX-VII

NATIONAL NUTRITION MONITORING BUREAU

(INDIAN COUNCIL OF MEDICAL RESEARCH)

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 partaken the meal

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

Weight of raw food in grams

Foodstuffs	Weight in grams	Foodstuffs	Weight in grams
Cereals		14. Leaf vegetables	
1. Ragi		15. Other vegetables	
2. Rice			
3. Maida		Roots and Tubers	
4. Rava		16. Carrot	
5. Wheat flour		17. Onion big	
6. Others		18. Potato	
		19. Tapioca	
Pulses		20. Others	
7. Bengalgram			
8. Blackgram		Nuts and oil seeds	
9. Kesari dhal		21. Cashewnut	
10. Lentil		22. Coconut dry	
11. Redgram		23. Coconut fresh	
12. Soyabean		24. Groundnut	
13. Others		25. Others	

Foodstuffs	Weight in grams	Foodstuffs	Weight in grams
26. Condiments and spices			
		Fats and oils	
		46. Butter	
Fruits		47. Ghee	
27. Amla		48. Hydrogenated oil	
28. Apple		49. Cooking oil	
29. Banana, Ripe			
30. Lime and Mango		Other foodstuffs	
31. Mango, Ripe		50. Betel leaves	
32. Melon, Water		51. Biscuit, salt	
33. Papaya, Ripe		52. Biscuit, sweet	
34. Tomato, Ripe		53. Bread, white	
35. Others		54. Sugar	
		55. Jaggery	
Fish		56. Papad	
36. Fish, fresh		57. Sago	
37. Fish, dry		58. Toddy	
38. Prawns		59. Horlicks	
		60. Farex	
Other flesh foods		61. Amul	
39. Meat		62. Amulspray	
40. Chicken		Others	
41. Liver, Goat			
42. Egg, Hen			
Milk and milk products			
43. Milk, Curds, Butter milk			
44. Skimmed milk, Liquid			
45. Cheese			

DIETARY INFORMATION

Meal pattern	Type of preparation	Ingredients used	Raw amount used (g/ml)	Total cooked amount (g/ml)
a	b	c	d	e
Early morning				
Breakfast				
Midmorning				
Lunch				
Evening Tea and snacks				
Dinner				
Others				

APPENDIX-VIII

Procedure adopted for biochemical estimation of haemoglobin
(Cyanmethaemoglobin method)

Principle

Haemoglobin is converted into cyanmethaemoglobin by the addition of KCN and ferricyanide. The colour of cyanmethaemoglobin is read in a photoelectric colorimeter at 540 nm against a standard solution. Since cyanides has the maximum affinity for haemoglobin, this method estimates the total haemoglobin.

Reagent

Drabkin's solution - Dissolve 0.05 g of KCN, 0.20 g of potassium ferricyanide and 1.00 g of sodium bicarbonate in 1 litre of distilled water.

Procedure

20 ml of blood is transferred with the help of a haemoglobin pipette and delivered on to a Whatman No.1 filter paper disc. The filter paper is air dried, labelled and can be stored upto one week. The portion of filter paper containing the blook is cut and dipped in 5 ml of Drabkin's solution taken in a test tube. Wait for 30 minutes and mix the contents in the tubes, take the reading in a photoelectric colorimeter. The reagent blank (Drabkin's diluent) is adjusted to zero.

Construction of standard curve

If the blood drawn from the subject contains haemoglobin 15 g/dl after estimation then the three reference standards prepared are as follows.

1. Reference standard A

4 ml of blood in 1000 ml Drabkin's reagent contains haemoglobin 15 g/dl.

2. Reference standard B

300 ml of reference standard A+200 ml Drabkin's reagent contains haemoglobin concentration of 10 g/dl.

3. Reference standard C

200 ml of reference standard A + 300 ml Drabkin's reagent contains haemoglobin concentration of 7.5 g/dl.

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

APPENDIX-IX

NATIONAL NUTRITION MONITORING BUREAU
(Indian Council of Medical Research)

Nutritional assessment schedule

State: Dist.: Taluk: Village:
Serial No. Family: Block:
Name of the child: Sex:
Name of the 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 :
4. Head circumference:
5. Chest circumference:

Clinical Examination:

Hair sparse	0.1*	Corneal opacity	12
Discoloured	02*	Night blindness	13
Easily plucked	03*	Photophobia	14
Moon face	04*	Anaemia	15
Parotid enlargement	05	Nasolabial dyssebacea	16
Oedema	06	Angular stomatitis	17
Emaciation	07	Cheilosis	18
Marasmus	08	Tongue red and raw	19
Conjunctival xerosis	09	Tongue Pappillae atrophie	20
Bitot's spot	10	Papillae hypertrophic	21
Corneal Xerosis/ Keratomalacia	11	Pellagra	22

*For children before 5 years

APPENDIX-X
Mathews Test for Mental Abilities

Tabulation

No.	Name	Age	Sex	Time taken in seconds												Raw scores	IQ
				1	2	3	4	5	6	7	8	9	10	11	12		

Raw score: (180 x N) - (T)

N = No. of problems attempted (including the 2 failures)
T = Total time taken for the N problems (failure are taken as 180 seconds each)

Formula for IQ:

$$IQ = \frac{X - \bar{X}}{SD} \times 15 + 100$$

$$SD = \sigma x = \frac{\sum X^2}{N} - \bar{X}^2$$

APPENDIX-XI

Formula for calculation of food use frequency

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

$$\text{Percentage of total score} = \frac{R_1 S_1 + R_2 S_2 + \ldots\ldots\ldots + R_n S_n}{n}$$

S - Scale of rating

R - Percentage of respondents selecting a rating

n - Maximum scale rating

NUTRITIONAL STATUS AND INTELLIGENCE OF PRE-SCHOOL BENEFICIARIES OF ICDS AND NON-BENEFICIARIES OF THRISSUR DISTRICT

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ABSTRACT OF THE THESIS

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ABSTRACT

A study on the nutritional status and intelligence of the pre-school ICDS beneficiaries and non-beneficiaries in Thrissur district was carried out among 80 ICDS beneficiaries and 70 non ICDS pre-school children.

The results of the study indicated that majority of the families in both the groups were Hindus and in the experimental group majority belonged to joint families while majority of the families in the control group were of nuclear type. Majority of the parents were educated and were engaged as agricultural labourers earning Rs.1001-2500/-.

Food consumption and dietary pattern revealed that rice was the staple food and the most frequently used food items were cereals, pulses, other vegetables, milk and milk products, fish, nuts and oilseeds, spices and condiments and sugar and jaggery.

Mortality and morbidity pattern was found to be very low among all the children and majorities were completely immunised in the ICDS group than the non ICDS group. Behavioural problems were found to be less among the ICDS beneficiaries and in the intellectual performance majority of the ICDS beneficiaries belonged to the average group.

The ICDS beneficiaries considered their supplementary food nutritious, sufficient and relishable. The Corn Soya Blend (CSB) was mainly served in the form of uppuma at the AWC.

Dietary profile of pre-school children revealed that the food intake was far below the RDA level for both the groups and the nutrient intake of the ICDS group met the RDA level and was found to be significantly better than the non ICDS groups when statistically analysed.

Prevalence of malnutrition as assessed by anthropometric measurements revealed that there was no incidence of severe grades of malnutrition among the pre-school children of both the ICDS and non ICDS group while the percentage of normal children being higher in the ICDS group.

Majority of the children in the experimental group had average IQ and IQ of the ICDS beneficiaries was found to be significantly better than their non ICDS counterparts. Both the ICDS and the non ICDS groups were statistically analysed to find out any correlation between nutritional status and intelligence and no correlation was found. When both the group were discussed as a single group and analysed 62.1 per cent and 18.4 per cent variation in IQ was explained by the nutrient intake (calorie, protein, iron and carotene) and anthropometric measurements respectively. The study shows a relationship between the nutritional status and intelligence among the ICDS beneficiaries.