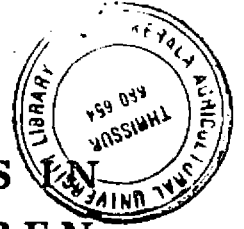# LEARNING DISABILITIES IN MALNOURISHED CHILDREN

BY

SANDHYA CHANDRAN

THESIS

SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENT FOR THE DEGREE OF

MASTER OF SCIENCE IN HOME SCIENCE

(FOOD SCIENCE AND NUTRITION)

FACULTY OF AGRICULTURE

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANANTHAPURAM

2001

DECLARATION

I hereby declare that this thesis entitled "Learning Disabilities in Malnourished Children" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Sandhya Chandra

Vellayani

DECLARATION

I hereby declare that this thesis entitled "Learning Disabilities in Malnourished Children" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.
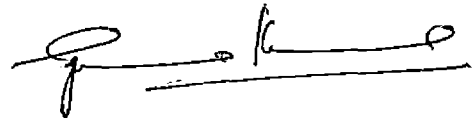
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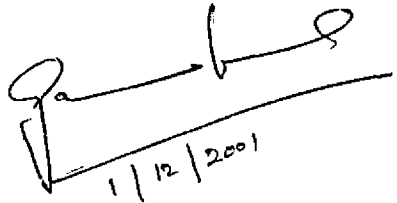
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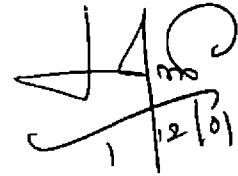
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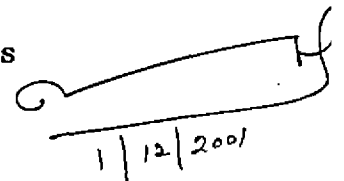   1.   Dr. (Mrs.) L. Prema
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At last but not the least I express my deepest gratitude to all my friends without whose encouragement and support through words and deeds, I would not have enjoyed my PG programme so much.

Sandhya Chandran

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DEDICATED
TO MY
FAMILY

INTRODUCTION

INTRODUCTION

Learning disability refers to a retardation, disorder, or delayed development in one or more of the process of speech, language, reading, spelling, writing or arithmetic resulting from a possible cerebral dysfunction and, or, of emotion or, behavioural disabilities (Kirk, 1970). Globally it is presumed that around 12 per cent children have been afflicted with this disorder. In Kerala, a pioneer study done by SCTIMST (1997), found that about 10 to 15 per cent of school going children are affected by learning disabilities.

Yet, these children who make up for a large percentage of school dropouts every year, in a cent per cent literate state, are neglected and left off the hook labelled as 'scholastically backward'. This not only results in a traumatic experience for these children, but also for their parents as well as teachers. Much of this happens as a result of pure ignorance about this phenomenon, on the part of educationists and parents. Many teachers and parents misunderstand these disabilities as simple difficulties in learning or lazyness of the child, leading to scholastic backwardness. Hence, they pressurise these children with constant nagging that little more hard work can make them overcome their learning disability, when in reality it is not so easy for the children.

As per Herman *et al.* (1982), children with learning disabilities are slow in learning, but they have normal or above normal intelligence, as history proves it. The likes of Albert Einstein, the mathematical genius, Thomas Alva Edison, the ingenius American inventor, Winston Churchill, the enigmatic politician and Leonardo da Vince, the famous painter, were all known personalities who suffered from learning disabilities in their childhood. But they all stand testimony to the truth that proper guidance and support can make a lot of improvement in this condition.

The normal learning process is the result of brain mechanisms operating from different parts of the brain. In children with learning disabilities all these brain mechanisms are present, but do not function the way they should. It is similar to a 'faulty wiring' in the brain leading to faulty expression of what is learnt by the child. And this is reflected as difficulties in reading, writing, arithmetics and spelling, causing demotivation and frustration in these children.

Though not much work has been done in India, many neurologists, educationists and social scientists in the West are relentlessly studying to find the exact cause of this phenomenon. So far, genetic and environmental factors, brain damage, malformation, delay in maturation and other biological reasons have been quoted by many. But as of yet not much work has been done to find whether learning disabilities is influenced by malnutrition.

It is an established fact that malnutrition critically affects the normal functioning of the human brain, long accepted as the seat of intellect. Even mild to moderate degrees of malnutrition can be associated with varying degrees of impaired cognitive abilities and consequently poor scholastic performance. Moreover, as per NNMB surveys (1994) in Kerala only 63.00 per cent of primary school children are normal while 25.03 per cent and 34.07 per cent were found to suffer from mild to moderate degrees of malnutrition. Hence it was considered appropriate in this context to probe into the possibility if any, of the impact of malnutrition on learning disabilities. Also alongside, the role of intelligence, demographic and socio economic factors in this association was considered in this study.

Statement of the problem

The present investigation intends to find out the nature and extend of the relationship that exists between malnutrition and learning disabilities in the children.

Objectives of the study

The main objectives set up by the investigator to achieve this are:

To estimate the relative effect of malnutrition on the learning disabilities of children between five and ten years.

The main objectives was then subdivided into specific objectives, to make detailed empirical investigation possible.

1) To understand the demographic and socio economic status of the subjects.

2) To determine the developmental, health and nutritional status of the subjects.

3) To understand the dietary habits and consumption pattern of the subjects.

4) To determine the level of learning disabilities, intelligence, malnutrition and overall development of the subjects.

5) To explore the relationship between learning disabilities, intelligence, nutritional status and overall development with each other and with all the other environmental factors.

6) To find out the association of demographic, socio-economic, developmental, health and nutritional and dietary factors with learning disabilities, intelligence, malnutrition and overall development of the subjects.

Hypothesis

For statistical computations, hypotheses were set up

This investigation was designed to test the major null hypothesi

that, there is no significant relationship between learning disabilities and malnutrition among children.

This hypothesis has been subdivided into a number of specific hypotheses inorder to make thorough empirical testing possible.

i) There is no significant difference. between the five groups of the sample in learning disabilities, nutritional status, intelligence and overall development.

i) There is no significant correlation between learning disabilities, intelligence, nutritional status and over all development and the various dimensions of environmental factors studied.

iii) There is no significant association between learning disabilities and some selected environmental factors.

Scope of the study:

In a country where "we live for our children" and a state where childrens' academic achievement is the lifetime ambition of the parents, poor scholastic performance, is rather a great problem of the society. Hence it is important to detect and diagnose learning disabilities early in childhood, as it is of great concern to the parents, the teachers and above all the affected child, who then can receive special corrective training. The scientific analysis of the underlying causes in the child or

in the environment will help to find a remedy to enable the child to perform better.

Malnutrition, is also one of the major problems of the school going population and research evidence support that malnutrition leads to impaired functioning of cognitive abilities and consequently poor scholastic performance. It is also proved that correction is possible with learning disabilities and mental deficit caused due to inadequate nutrition by providing appropriate stimulation sufficiently early. However, systematic data relating to malnutrition and other environmental factors is not available at present. Hence this study may enlighten, the parents, teachers and policy makers on the prevalence and causes of learning disabilities. Also the scientific analysis of the underlying causes in the child and the environment will help to plan suitable measures to remove the constraints and to find appropriate remedies to enable the child to perform better.

When the success rate of school going population is only 30 to 40 per cent in Kerala, even after attaining 100 per cent literacy rate, such a study is very relevant.

Limitations of the study

The investigation was done systematically using scientific procedures. However, since the research programme was undertaken as a part of the requirement of Master's Degree programme of the investigator, an extensive study in greater

depth and in more comprehensive manner could not be carried out due to constraints of time and resources. It is also admitted that the investigation was restricted to a particular area, considering convenience and proximity. Still, the results of the study could throw some light into the investigation and facilitate for further research in the field.

Organisation of the thesis

The procedures undertaken for this investigation including analyses and results are presented in Chapters 2-6

Chapter 2   -   includes related literatures which contains studies in the relevent area.

Chapter 3   - includes the methods and materials used for the investigation as well as the statistical tools used.

Chapter 4   -   includes the results obtained after the analyses of the data collected.

Chapter 5   -   includes the interpretation of the results, supplemented with relevent studies.

Chapter 6   - includes the summary and conclusion as well as suggestions for further investigations on this topic.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The present investigation is carried out with a veiw to understand the relationship if any that exists between malnutrition and learning disabilities as well as intelligence in children. Hence a brief review of literature relating to the factors that lead to learning disabilities and malnutrition in children with special reference to intelligence, development, demographic, socio-economic and health factors is given. The review is divided broadly into

1. Learning disabilities, its prevalence and etiology

2. Intelligence, assessment and influencing factors

3. Malnutrition, influencing factors and impact

4. Association of learning disabilities with malnutrition and intelligence

What is Learning Disability?

"We dance round in a ring and suppose,

But the secret sits in the middle and know.

He is indeed the "not quite child".

In search of a solution for learning disability Stoc (1979) attempted to define the problem by intuition an understanding. She labelled the learning disabled child as th "not quite" child. She describes him as a clock in disrepai.

chimes only on the half mark missing the whole completely. He defies age, as he is too young, too old and too tormented. He is on the right side of every educational cliche ..... "study more", "work harder" and the wrong side of real meaning.

In the early days, one of the most widely used definition of learning disabilities is the federal definition, given by the National Committee on Handicapped Children, in the US (1985). The definition read as;

"Learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written which may manifest itself as an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations.

To further clarify the term learning disabilities a separate set of federal regulations was put forth an accordingly, a child has a specific learning disability if:-

1) "the child does not achieve commesurate with his or her a and ability levels in one or more of several specific areas whe provided with learning experiences appropriate for the child' age and ability level. and:

2) the child has a severe discrepancy between achievement a intellectual ability in one or more of the following areas:-

i) Oral expression

ii) Listening comprehension

iii) Written expression

iv) Basic reading skills

v) Reading comprehension

vi) Mathematics calculation

vii) Mathematics reasoning"

There were certain draw-backs in this definition and hence it was widely criticized. To address these criticisms, the NJCLD (1987) proposed a new definition which is presented as follows:

'Learning disabilities is a general term that refers to a heterogenous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, measuring or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction and may occur across the life span.

Crouse (1999) had defined the term 'children with learning disabilities' as those who have a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in imperfect ability to listen, think, speak,

read, write, spell or do mathematical calculations. Such disorders include conditions like perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia and developmental aphasia. Such term does not include children who have learning problems which are primarily the result of visual, hearing, or motor disabilities of mental retardation, of emotional disturbance or of environmental, cultural or economic disadvantage.

As per National Institute of Health (2000), LD is a disorder that affects people's ability to either interpret what they see and hear or to link information from different parts of the brain. These limitations can show up in many ways: as specific difficulties with spoken and written language, coordination, self control or attention. Such difficulties extend to school work and can impede learning to read, write or do maths.

Prevalence

Empirical studies indicate that learning disabilities today is found to be prevalent among a notable percentage of population throughout the world. Estimates of the prevalence of learning disabilities vary from 10 to 30 percent of the school population depending upon the criteria used to determine their eligibility (Lerner. 1993). In an early study of 2,800 third and fourth grade pupils in the Trivandrum district, researchers found

that 7 to 8 percent had learning disabilities (IRCCD, 1999). In a recent study conducted in the whole of Kerala at the Department of Neurology. Sree Chithra Thirunal Institute for Medical Sciences and Technology (1999) has proven that at least 10% of the child population has learning disability or any other developmental language disorder.

Learning disabilities is the largest category of special education. Yeseldyke and Algozzine (2000) reported that in the U.S. about 28 to 64 per cent of the students receiving special education in recent years were identified as learning disabled. This denotes the gravity of the problem faced by the educationists today.

Information is available on sex differences also. Boys are diagnosed as being learning disabled four to eight times as often as girls (Marsh and Gearhart, 1988). Similarly Suchithra (1997) had also opined that boys are affected three times more than girls because of genetic reasons.

Etiology:

As of yet clear answers on causes of learning disabilities has not ... been identified. A leading theory among scientists is that learning disabilities stem from subtle disturbances in the brain structures and functions (Cruickshank and William. 1992). For quite some time brain damage has been

suspected of being a cause of learning disability, but modern concepts of minimal brain dysfunction have developed recently. The incidence of learning disability is more than the combined total of mental retardation, cerebral palsy and epilepsy (Goldberg and Schiffman, 1987).

Some of the possible causes for learning disabilities as assumed by researchers has been divided into three general categories.

i) Genetic causes

ii) Environmental causes

iii) Organic and biological causes

One of the other debated issue is the possibility of a genetic basis of learning disability. Over the years, evidence has been accumulating that learning disabilities tend to "run in families" (Finucci and Childs, 1983; Owen et al., 1991). A chromosomal abnormality also has been found in some learning disabled children. Learning problems may be caused by an extra 'Y' chromosome in males or just on 'X' chromosome in females (Pennington and Smith. 1993). There is also some evidence that children who have certain medical conditions such as Tourette Syndrome (Burd. 1993), Fragile 'X' syndrome (Santos, 1994) or Turner Syndrome (Rovet. 1996) have a higher than expected incidence of learning disabilities.

The environmental causes of learning disability has been listed under social and cultural factors, educational factors and factors concerning the family. The familial factors include child rearing. values, economic disadvantages, lack of opportunities and lack of health care. Under the educational factors, the most prominent cause of learning disability is reported to be poor teaching (Engelmann and Lovitt, 1987). According to them this condition is not inherent in the child, but is brought about by inadequate instruction. But Cole (1987) put forth the "interactivity theory in which he states that learning problems are not caused by any one of these factors, rather it is due to a complex interplay of all these factors.

Westman (1990) had tested the organic and biological causes of learning disability as trauma, toxicity, disease, malnutrition. maturation. sensory deficits and seizures. Neurological impairments affecting specific brain functions are seen in majority of children with learning disabilities (Gaddes, 1995). A lag in the maturation of the brain, developmental anomalies in the left temporal region and deficits in the immune system are also looked upon as possible causes of learning disabilities.

Gesell (1989) an authority in the field of education in writing about the development of children has also expressed the belief that unrecognized minimal birth injury may express itself in speech difficulty and may later appear in the form of reading

difficulty. The relationship of birth complications and learning disabilities was also reported by Walsh and Linderberg (1990). They explained hypoxia or lack of oxygen supply that a child suffers during birth, can lead to damage of the optic nerve pathway. These children can also suffer from epilepsy or cerebral palsy with severe degrees of hypoxia. And with minimal degrees of hypoxia, a less severe neurological impairement could result in the child developing speech difficulties or learning disabilities. An interesting series of case was reported by Kawi and Pasamanik (1994). These men studied the records of 205 children who had reading problems. It was found that 16.06 per cent of them had been exposed to two or more complications during birth or immediately thereafter. Records of a similar group of children without reading problems revealed that only 1.05 per cent of this group had any complications at birth.

What is intelligence?

Intelligence is a complex aspect, which includes behaviour as the activity component. Many psychologists have evolved many definitions of intelligence.

Brown (1978) defined intelligence as the ability of an individual to adjust himself to the conditions that arise in his environment.

Weschler (1981) was of the opinion that intelligence is the aggregate or global capacity of the individual to act

purposefully, to think rationally and to deal effectively with his environment.

Intelligence as per Norman and Munn (1984) is the flexibility or versatility and is a function of living organism.

Thorndike (1989) explained intelligence as the ability of an individual to cope with his environment. It may be thought of as a composite or organisation of abilities to learn, to grasp, broad and subtle facts, especially abstract facts, with alertness and accuracy to exercise mental control and to display flexibility and ingenuity in seeking the solution of problems.

The specific abilities of intelligence include memory, linguistic ability and comprehension, logical reasoning, spatial orientation and numerical ability.

Assessment of intelligence

Intelligence is usually assessed by formal intelligence tests meant for children and adults. Childrens' intelligence tests are designed to assess their intellectual attainments in different fields including many qualities and skills that are not formally taught at school. A child's score on an intelligence test is usually expressed in terms of intelligence quotient (IQ). Most of the available tests for the assessment of intelligence and other personality dimensions have been devised in the West. Although this is so. all of them, does not suffer from cultural

organism. Newman (1992) concluded that variation in I.Q wer

determined about 68 per cent by heredity and 32 per cent b

environment.

b) Environment

An individual's life variations in I.Q must be due

environment, since heredity cannot change. Cases are record

where this change is as much as 20 per cent. Improved nutritio

health and stimulus situation would account for this chan

(Dahama and Bhatnagar, 1988). As per Hurlock (1989) environme

of the children at primary school age appear to be critica

since the child normally learns the language at this tim

Better house, school, medical care and less econom

discrimination provide a means for achieving a mentally ali

population.

i) Nutrition

Among the most influencing factors on a child

intellectual development is nutrition. During the months befo

birth and through early childhood years, malnutrition interfer

with the development of the brain. This inturn affects t

child's ability to learn. If malnutrition is not corrected

this time, the brain growth and development will be stunted f

ever resulting in lower levels of intelligence in childre

(Hurlock, 1989).

Upadhyay (1989) pointed out that even moderate degrees of malnutrition influences the I.Q scores and its effects is of a higher magnitude on immediate memory, visual perception, visual-motor integration as compared to verbal reasoning and comprehension.

Sigman *et al.* (1992) in their clinical trials found that those children deprived of adequate nutritional support during early period of life ie. especially through breast feeding and other supplementations showed marked cognitive incompetence in the later stages of life. Bartel *et al.* (1998) reported that children who suffered from early malnutrition scored less in their intellectual performances due to delayed psychomotor development.

Apart from nutritional factors, other environmental factors such as socio economic and educational level of families are strongly associated with cognitive performance of children in countries where variation in nutritional intake and economic level of schooling are limited (Johnson *et al.* 1989; Winick *et al.*, 1989; Ricciuti, 1993). As per Rao (1994) environmental factors which are found to be adversely associated with poor intellectual ability in children are. low job security and family income, low educational levels of parents, poor living conditions and hygiene, high morbidity, inadequate food, over crowding and lack of parental attention, awareness, closely placed pregnancies, lack of support, during crisis and poor adult - child interaction.

ii) Age:

As per Dahama and Bhatnagar (1988) a person who is bright or dull in childhood tends to remain bright   or dull throughout his life and that age is of minor importance as far as intelligence is concerned.   Studies have   shown that a person achieves his maximum I.Q. at about 20 years and remains relatively stable until around 70 years when it rapidly decreases, unless if health and other factors do not interfere (Molloy et al., 1990; Stanovich et al., 1991) and hence they opined that consideration of age is of minor importance as far as intelligence is concerned.   But developmental science indicates that 90 per cent of brain development is complete by six years and 99 per cent by eight years.   Any hinderance during this period can cause irrepairable damage.

iii) Sex

Crow and Crow (1985) reported that, analysis of performance in scientific items of intelligence tests appeared to show that the performance of boys were slightly superior as far as mathematical material and scientific concepts were concerned while girls excelled in materials that dealt more directly with the humanities.   Saito et al. (1986) similarly reported that high school boys excelled in more abstract areas of learning such as mathematics and physical sciences compared to girl students.

iv)   Health and physical development

Physical and psychological health status can be related to one's ability to gain desirable achievement   in intellectual activity. As far as physical health and intelligence is concerned McGregor (1987) opined that the strongest predictor of intellectual deficit in children was the degree of growth retardation which might be resultant of nutritional deficiency. or maternal malnutrition or due to some biological interventions. Physical defects such as related or incomplete maturation of brain cells may result in subnormal intelligence.

Physical handicaps such as blindness, or near blindness and deafness and other sensory handicaps may interfere with observable intelligence behaviour (Vagh and Anutai, 1992). Conditions such as glandular imbalance such as hypothyroidism and hyperthyroidism and enlarged adrenoids also affect intelligence (Rizzo et al.. 1997).

v)   Social and economic conditions

Not only nutrition affects the intellectual development but also many other factors such as socio cultural and economic background of a child's environment.

Ashworth (1986) revealed that poor social environment low family income and literacy level of the family members has a direct influence on the nutritional status of a child which inturn influences his intellect.

Rao (1993) reported that the social factors that were found to be adversely associated with poor intellectual ability in children were low job security and family income, low educational level of parents, poor hygiene and living conditions. Singh (1993) in his study proved that social and economic factors were more highly related to the test performances of perceptual abilities and arithmetic achievement than nutrition variables.

What is malnutrition

The term malnutrition is generally better understood than intelligence, behaviour or mental development. It has been defined as a state wherein adequate nutrients are not delivered to the cells to provide the substrate for optimal functioning (Vazir *et al.*, 1992). Similarly Morrison and Hark (1996) defined malnutrition as a condition wherein a suboptimal (deficient or excessive) supply of nutrients interferes with an individual's growth. development and maintenance of health.

As far as human beings are concerned, it can occur at any age as either general malnutrition ie, starvation or as a syndrome due to the deficit of specific nutrients such as calories, protein, particular vitamins and minerals. Although the term malnutrition includes both undernutrition as well as over nutrition. in developing countries. like India, malnutrition due to deficient quantity and quality are the major health problem.

Factors influencing malnutrition

As per Beaton *et al.* (1990) the chief immediate causes of malnutrition indexed by growth failure are inadequate child care and attention, inappropriate feeding practices leading to diet deficiency in quantity or quality and high rates of infection. Benjamin and Zachariah (1993) conducted a study of under three years in Ludhiana. Accordingly, sex, birth order number of siblings, education level of parents and family income were the factors found to be associated with childhood malnutrition. Darar *et al.* (1995) reported that low economic status, poor environmental hygiene coupled with illiteracy in mothers may contribute to higher incidences of malnutrition.

Agarwal *et al.* (1989), Marjoribanks (1990) and Mosyechuk (1992) in their studies on malnourished children have shown that their family characteristics including economic resources, biological and socio cultural characteristics of parents. family structure and stimulation of home are associated with normal nutritional status. Harrel *et al.* (1989) had opined that nutritional problems were associated with insufficient income, inadequate diet, low level of schooling, poor housing facilities and insanitary living conditions. Gosh (1989) had also pointed out that factors like religion, occupation, economic status. education, belief and culture had important bearings on nutritional status.

Pollitt and Thomson (1996) opined that malnutrition is almost always associated with poor social background which themselves have a detrimental effect on mental development.

As per Elizabeth (1998) abrupt withdrawal of breast milk, delay and inadequate weaning, lack of food supplementation in young children are direct determinants of malnutrition.

Impact of malnutrition

Malnutrition never occurs alone and the effect of other adverse factors which usually accompany food deprivation cannot be ruled out. They may independently exert adverse influence or intellectual as well as psychomotor development and learning skills.

There has been growing evidence to support that malnutrition leads to impaired functioning of cognitive abilitie and consequently poor scholastic performance   (Das and Pivato 1985; Stoch and Smythe, 1985; Cebak and Najdanvie, 1990 and Sing et al. 1996).

Winick and Rosso (1988) classified brain growth int three phases. The earliest hyperplasia, where number of brai cells increases while size remains constant, the secon hyperplasia with hypertrophy where cell divisions slows while it size increases and the third hypertrophy where the cell divisio stops, while cell size and weight increases. And in each phas

experience, learning and nutrition influences neural growth differently. If any form of nutritional hinderance is experienced in any of these phases it can lead to permanent damage to the intellectual development.

Similarly Monckeberg (1991) through his clinical studies had proved that the effects of malnutriton on I.Q. during hyperplasia where irreversible because the number of brain cells cannot be increased later through proper nutrition. Singh and Dutt (1992) on the basis of their studies supported that malnutrition affects the intellectual abilities, visual motor functioning and academic achievements of rural primary school going children.

Several studies undertaken in school age children suffering from even mild to moderate degrees of malnutrition have shown that I.Q., learning skills, social achievement, visual perception. visual motor coordination, reasoning, spatial perception and perceptual abilities remain affected (Hertzig *et al.*. 1989: Cravioto *et al.* 1990 and Champakam *et al.*, 1995).

Klein *et al.* (1994) was of the view that there is a close relationship between malnutrition and cognitive development. They reported that in malnourished children the cognitive development was found to be slower and growth of brain was retarded, besides affecting the all round physical growth of the child.

Association of learning disabilities with malnutrition and intelligence

Not many studies are available as far as association of LD with malnutrition and intelligence is concerned. Still, of recent. attempts has been made to find any possibility of nutrient involvement in this phenomenon.

Colgan and Colgan (1994) experimented in children with learning difficulties by supplementing their diets with individually designed vitamin and mineral supplements. As a result it was noticed that there was marked improvement in reading skills followed by behavioural improvement thus suggesting that subtle nutritional variables exert a substantial influence on learning and behaviour.

Strody (1997) published her much acclaimed work relating deficiency of essential fatty acids and dyslexia, a specific learning disability (difficulty in reading). In this study she made the discovery that children who were dyslexic when supplemented with essential fatty acids showed marked improvement in the functioning of the photoreceptors necessary for efficient reading and writing.

Schunk (1998) explained that malnutrition prior to birth can cause altercations in skeletal size and cerebral development. The malnutrition that is more associated with LD is

not the type that affects the development but the social performance of the child because of his preoccupation with his immediate needs. In another clinical trial of Carlton *et al.* (2000) an attempt was made to find the effect of dosages of nutrients like B vitamins and minerals in children with learning disabilities. Based on the trial results the researchers opined that the study tentatively supported the concept that learning disabilities may in some cases be a nutrient - responsive disorder.

As far as intelligence and learning disabilities is concerned, according to Filskov and Bull (1982) when intelligence in study sample with learning disability was formally measured it was found to be normal or moderately reduced. The full scale I.Q. was generally within normal limits although more carefull scrutiny brought out a significant point that it was usually low for the expected average for the family.

Likewise Galler *et al.* (1984) reported that reduced performances in the previously malnourished children can be largely accounted for by deficits in class room behaviour and to a lesser extent by reduction in I.Q. They also reiterated that an early history of malnutrition and its accompanying conditions at the time of illness are leading contributors to altered behavioural outcome and learning difficulties.

MATERIALS AND METHODS

MATERIALS AND METHODS

The following procedures were carried out to achieve the objectives put forth in the present study,

3.1 Selection of area

3.2 Selection of sample

3.3 Conduct of study

3.4 Statistical analysis

3.1 Selection of area

Athiyanoor and Vattiyoorkavu blocks of Trivandrum rural were purposely chosen for the conduct of the study considering the easy accessibility to these localities. The sample for the study were drawn through stratified random sampling from Lower Primary Schools (LPS) in the selected areas. Apart from the three LPS, one Primary Health Centre (PHC) and an institute for training and rehabilitation of children with communication disorders and learning disabilities were also identified and selected for the study.

Three schools with mixed population of girls and boys were selected from the Venganoor panchayat of Athiyanoor block giving due representation to Government, aided and private managements. Accordingly the schools chosen for the data collection were;

i)   Mudippuranada L.P.S. (Government)

ii) Ayyankali Memorial School (Private)

iii) St. Mary's L.P.S., Nellivila (Private aided)

The Primary Health Centre (PHC) from the Kottukal block situated near the coastal areas of Vizhinjam and reported to be having high incidences of nutritional problems among children were purposely selected to constitute the malnourished population of the sample.

The Institute for Rehabilitation of Children with Cognitive and Communication Disorders (IRCCCD), a sister organisation of SCT Hospital at Medical College, Trivandrum identifies children with learning disabilities and rehabilitates them through training and counselling. This is the only such kind of rehabilitational institute functioning for learning disabled children in the District. This institute situated at Ulloor panchayat of Vattiyoorkavu block was chosen for studying children with Learning Disabilities (LD).

3.2 Selection of sample

The main respondents of the study constituting of th children from the identified institutions were selected based c certain study criteria.

3.2.1. Selection criteria

The sample from the identified institutions were drawn with the following criteria.

i)   Boys and girls within the age group of 5 to 10 years

ii) Normal children of the identified schools selected from classes I to IV and getting the top most, lowest and average ranks in the previous terminal examination. A total of 60 were proposed to be selected for each group, with an average of 20 from each school.

iii) Malnourished children ranging from mild to moderate degrees of malnutrition from the identified PHC. And it was proposed to select 60 children in this group also.

iv) Sixty children identified from IRCCCD having LD.

3.2.2 Exclusion criteria

i)   Children with severe health problems.

ii) Children not belonging to the age group of 5 to 10 years.

iii) Children not belonging to those identified institutions.

3.2.3 Sample from schools

The children in this group were selected from 1-4 standards of the three schools. From each of the four standards three groups of children possessing top most rank, average rank

and lowest rank were chosen (represented as Group I, Group II and Group III). From each standard, five children were included in each of the three groups viz. Group I, Group II and GroupIII, thus a total of 15 children from each standard were selected. Accordingly a total of 180 children with 60 children from each of the three identified schools formed the three subcategories of the total sample. The selection procedure is illustrated in Table 1.

Table 1

Distribution of samples selected from schools

SCHOOLS	CLASSES	SELECTED GROUPS			TOTAL
		GI	GII	GIII	
MUDIPPURANADA LPS (Govt.)	I	5	5	5	15
	II	5	5	5	15
	III	5	5	5	15
	IV	5	5	5	15
TOTAL		20	20	20	60
AYYANKALI MEMORIAL LPS (Pvt.)	I	5	5	5	15
	II	5	5	5	15
	III	5	5	5	15
	IV	5	5	5	15
TOTAL		20	20	20	60
ST. MARY'S LPS (Govt. aided)	I	5	5	5	15
	II	5	5	5	15
	III	5	5	5	15
	IV	5	5	5	15
TOTAL		20	20	20	60
GRAND TOTAL		60	60	60	180

3.2.4   Sample from PHC

This group comprised of children suffering from mild to moderate levels of malnutrition. Though it was originally proposed to include 60 children in this group, only 30 of them falling within the age group of 5 to 10 years, as per the study criteria could be located at the PHC. Their degree of malnutrition was ascertained with the help of the General Physician of the PHC (This group is referred to as Group IV hereafter).

3.2.5   Sample from IRCCCD

Children with different learning disabilities were chosen from the IRCCCD. These children were identified cases of LD and were undergoing training and counselling in this institution. Only 30 children belonging to the age group 5-10 years could be identified from this institution, even though it was proposed to include 60 of them for the study (referred hereafter as Group V).

Thus the sample selected for this study comprised of a total of 240 children within the age group of 5 to 10 years drawn from identified institutions namely schools, PHC and IRCCCD. The description of the final sample is illustrated in Table II below.

Table 2

Group wise distribution of the sample

| | SCHOOLS | | | PHC | IRCCD | Total |
	Group I	Group II	Group III	Group IV	Group V	
BOYS	27	28	29	12	26	122
GIRLS	33	32	31	18	4	118
TOTAL	60	60	60	30	30	240

3.3. Conduct of study

Keeping in focus with the objective, appropriate tools were selected and put to use for the conduct of study after pretesting and standardisation. With the aid of the selected tools, following aspects were studied in detail.

3.3.1 Demographic and socio-economic profile

3.3.2 Details on developmental, health and nutritional status

3.3.3 Dietary habits and food consumption pattern

3.3.4 Assessment of LD

3.3.5 Assessment of intelligence

3.3.6 Assessment of overall development

3.3.1 Demographic and socio-economic profile

Evans and Divan (1985) had stated that there is no significant difference among the different methods like oral, recall, printed questionnaire and interview method. However,

Britten (1995) regarded interviewing as a well established research technique. Accordingly a suitably structured and pre tested interview schedule was used to elicit information regarding demographic and socio-economic profile of the sample. The mother of the child was interviewed to whom the investigator presented each item by means of specific questions and continued the dialogue until sufficient information was gathered.

The questions to elicit information regarding age, sex, place of residence, religion, caste, monthly income, monthly expenditure pattern, type of house, necessities and conveniences available, type and size of family, parent's educational and employment status, number of siblings and order of birth of the child were included in the schedule. The schedule is illustrated in Appendix I.

3.3.2 Details on developmental, health and nutritional status

3.3.2.1 Developmental details

According to Illingworth (1989) a review of developmental history is vital for developmental diagnosis of a child. Hence a schedule was prepared to review the developmental history of each child. This includes assessment of both physical and psychological development.

Under physical development the details regarding birth weight, term of birth, type of delivery, history of feeding,

Collection of data from parents

immunisation details and childhood illnesses and accidents were also included.

Details regarding the developmental problems if any in social. emotional, intellectual areas along with sleep and behaviour problems were included under psychological development.

All the details pertaining to these aspects were collected by interviewing the mothers. The interview schedule used is shown in Appendix II.

3.3.2.2 Details on health and nutritional profile

In order to assess the health and nutritional status the details on their anthropometric measurements and presence of clinical symptoms of malnutrition were recorded.

3.3.2.2a Anthropometry

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

In this study nutritional anthropometry was adopted since the pattern of growth and physical fitness of an individual though genetically determined are profoundly influenced by diet as explained by Ghai (1996).

Among the different measurements commonly used, the following nutritional indicators were selected in this study as they are found to be most appropriate to assess the nutritional status of children between the age of 5-10 years.

i. Weight

ii. Height

1. Weight

Weight is the measurement of body mass (Rao and Vijayaraghavan, 1986). Weight deficit is one of the most reliable indicator of the prevalence of protein energy malnutrition among all age groups. Jelliffee (1966) stated that comparison of weight for age values with a recognized standard at corresponding ages will help to determine the degree of underweight in a community.

The weight of the subjects were measured using a beam balance since it is less likely to be inaccurate if carefully handled. Each subject was made to stand at the centre of the platform without holding on to any supports. Care was taken to use the balance on a firm even surface and it was checked for any faults before use. The measurements were done to an accuracy of 0.1 kg. The weights thus obtained were compared with national (Vijayaraghavan, 1986) and international (NCHS, 1990) standards.

Measurement of weight

Measurement of height

2) Height

Height is a linear measurement made up of the sum of four components, leg, pelvis, spine and skull. The extent of height deficit in relation to age as compared to recognized national and international standards is regarded as a measure of the duration of malnutrition as pointed out by Gopaldas and Seshadri (1987).

Any deficit in height reflects a short period of growth failure during early stages or a longer period of growth failure at a later stage. Hence, the height of all subjects were measured and compared with both national (Vijayaraghavan, 1986) and international (NCHS, 1990) standards.

The height was measured using a stadiometer. The children were made to stand on a flat floor by the scale with feet parallel and with heels, buttocks, shoulder and back of the head touching the upright. The head was held comfortably erect with the lower border of the orbit in the same horizontal plane as the external auditory meatus. The arms were hanging at the sides in a natural manner. A wooden block was used as head piece which was gently lowered crushing the hair and making contact with the top of head. The measurements were made to the nearest 0.5 cm.

3.3.2.2b Clinical assessment

As per Swaminathan (1998) clinical examination is the most important part of nutritional assessment as direct information of signs and symptoms of dietary deficiencies prevalent could be obtained. Hence the whole sample were subjected to clinical check up with the help of a qualified physician by using the proforma prepared by NIN (the proforma is shown in Appendix III).

3.3.3 Dietary habits and food consumption pattern

The dietary habits and food consumption pattern of the sample were also collected from their mothers with another well structured interview schedule. The schedule consists of questions to elicit information regarding their food habits, frequency of meals per day and food use frequency (the schedule is enclosed in Appendix IV).

The frequency of use of different food groups would give an indication of an individual's diet adequacy, as observed by Nelson (1993). Hence food use frequency was ascertained by applying the scores specified in Table-3.

Table 3

Food use frequency score

Frequency of use	Score
Daily	4
Thrice a week	3
Once a week	2
Once a month	1
Never	0

A qualitative measurement of the adequacy of each child's diet was made by recording three day's menu and then verifying to see whether the diet constituted of food from all the five groups and also to assess the frequency of consumption of food from each group.

3.3.4 Assessment of LD

Commonly used formal standardized tests for assessing LD are tests of mental abilities and mental processes (eg. Wescheler Intelligence Scale for Children, Revised, WISC-R), Reading tests (e.g. Gates - MacGinite reading tests), other academic skills (e.g. - Kaufman Test of Educational Achievement, K-TEA). Motor tests (eg. the Peabody Developmental Motor Scales), Language tests (eg:- the Houston test of Language Development) and Screening test for mathematical skill.

But most of these tests could be administered only by qualified Clinical psychologists. However, an indigenous test material developed by IRCCCD taking into consideration the various facets of LD is proved as a reliable and easy to administer test. This was the test used to assess LD of children in the present study. The test material structured had four sections.

  i) Parent's evaluation of LD

  ii) Investigator's evaluation

iii) Evaluation of Language and Writing Skill

  iv) Evaluation of Arithmetic Skill

i) Parent's evaluation of LD

The first section constituted of a set of 26 questions, the answers for which are obtained by the investigator through interviewing of the child's parent. The questions were formulated in such a way that it specifies on various characteristic behaviour seen in children with learning disabilities.

The scoring was done on a 2 point scale ie, if a question pertaining to a characteristic feature of LD yields a positive answer, then a score '2' is given. If the answer is negative then the score is '1'. Hence, for a child who according to his or her parent's perception, exhibits behaviour typical of LD, the total score obtained will be more compared to that of a

child who shows less behavioural symptoms. Thus the maximum score obtainable in this section is '52' and the minimum score is '26'.

ii) Investigator's evaluation of LD

The second section of the test material had a set of 10 questions which was assessed by the investigator herself through close observation of each child. These questions are also related to typical behaviour in LD. The higher the score obtained greater is his or her level of disabilities. The maximum score obtainable here is '20' while the minimum score is '10'.

iii) Evaluation of Language and Writing Skill

The Language and Writing Skill is tested in this third part of the test material, to see whether the child has any disabilities in this area of learning. LD is identified from the scores obtained from the test, in such a way that each wrong answer would be given a score '2' while each correct ones will be given a score of '1'. Accordingly as in other sections a child with more number of errors will be getting the highest score. The highest possible total score in this section is '128' while the minimum is '64'.

iv), Evaluation of Arithmetic Skill

This section of the test measures the child's disability in simple arithmetic skills (discalculia) like number

writing, addition, subtraction and multiplication. As in the case of other sections here also, score '1' is assigned to each correct answer and '2' for each wrong ones. The maximum score a child can get is '44' and a minimum of '22'.

Lastly the total scores in each section is added up to get the grand total score of the test for which the maximum is 244 while the minimum obtainable is 122. Thus each section will assess the child's disability in the specific area of learning. The test material used is shown in Appendix V.

3.3.5 Assessment of Intelligence

Intelligence can be defined as the ability to absorb new information, remember it and use it to solve new problems. To some extent a person's intelligence is determined before birth and may depend on the pattern of genes received at conception. But how intelligent he becomes depends also on his early environment.

Intelligence is usually assessed by formal intelligence tests. These are designed to assess a child's intellectual attainments in different fields including many qualities and skills that are not formally taught at school.

Measuring intelligence involves the social stimulu value of the individual ie, the individual's inner *dynamics* an traits must be understood and measured by standard tests an

observations. The test should assess qualitatively and quantitatively the various components of cognition viz., attention. sensation, imagination, memory, conceptions argument and reasoning.

Besides, any good measuring instrument should have the following characteristics

i)   Validity - It is that device which measures what it is supposed to measure.

ii) Reliability - It is determined by a device which shows consistency in giving the same score for the same group or similar groups for each tests.

iii) Objectivity - It means that when two or more people using the same measures will get the same results.

iv) Standardisation - It means that norms or standards have been established so that an individual's score can be compared with scores of others of a definite group. All the above parts have been considered while selecting the two tests of intelligences.

The details regarding the two standard tests used for this study is discussed below.

3.3.5.1 Raven's Coloured Progressive Matrices (CPM)

For the present study this test was used as one of the two tools since Raven et al (1982) in a briefing about this test

had said that this can be used satisfactorily with people suffering from any form of LD as to measure their level of intelligence.

Of the many intelligence tests available CPM was particularly chosen for the following reasons

i)   The test is recommended for use with young children as well as older ones for anthropological studies and for clinical work

ii) It can be used satisfactorily with people, who for any reason cannot understand or speak English language

iii) It is recommended for people suffering from physical disabilities, aphasias and cerebral palsy, deafness or people who are intellectually subnormal or who have deteriorated. Hence this test could be appropriately used for testing intelligence of both normal and children with LD alike.

This test comprises of 36 items of puzzles in 3 sets of 12 each: A. Ab and B. These 3 sets of 12 problems are arranged to assess the chief cognitive processes of which children under 11 years of age are usually capable. The 3 sets together provides 3 opportunities for a person to develop a consistent theme of thought and the test of 36 puzzles as a whole is designed to assess as accurately as possible, the mental development of an individual upto intellectual maturity.

The test was administered by the investigator to a group of 5-6 children at a time. The scoring procedure is that each correct answer is given a score of '1' and wrong ones '0', thus the total score obtained known as the raw score is then related with the physical age of the child taken in years and months to determine the percentile rank obtained. Based on the percentile rank, the level of intelligence is graded as follows.

Grade I   -   "Intellectually superior" if the score lies at or above the 95th percentile for people of that age group.

Grade II   -   "Definitely above average in intellectual capacity" if score lies at or above 75th percentile.

II^+ if a score lies at or above 90th percentile.

Grade III -   "Intellectually average" if score lies between 25th and 75th percentile.

III^+ if score is greater than median or 50th percentile.

III^- if score is less than the median.

Grade IV   -   "Definitely below average in intellectual capacity", if score lies at or below the 25th percentile.

IV^-, if a score lies at or below the 10th percentile.

Grade V   —   "Intellectually impaired" if a score lies at or

below the 5th percentile for that age group.

(Raven *et al.*, 1982)

A sample of the CPM and its score sheet is shown in Appendix VI.

3.3.5.2 Draw-a-Man Test

As both normal and problem children are included in the study it was decided to include a complementary test which is easy to administer for a reliable and valid assessment. The studies of a child's drawing have shown conclusively a significant relation between the drawing development and intellectual maturity. Therefore the Draw-a-man test by Pathak (1987) was also included. As in CPM a child's clarity in observation, comprehension, retention and augumentation can be measured using this scale. Also it can be suitably used for children between the age group of 5 to 10 years.

This screening test requires only a paper and a pencil and can be administered to a group of children simultaneously in a class-room. There are scores for each feature of the picture as per the test manual based on which scores are given. The total score thus obtained for the drawing is considered as the raw score for the test. Using this raw score IQ, is calculated with the formula

Administering Raven's CPM test

Administering Draw-a-Man Test

$$IQ = \frac{\text{Mental age}}{\text{Chronological age}} \times 100$$

where, Mental age is the age equivalent to the observec raw score and chronological age is the actual physical age of the child recorded in years and months.

The deviation IQ was then determined using the test manual and thereafter the percentile rank. The score card and a sample drawing is given in Appendix-VII.

3.3.6 Assessment of overall development

Development can be defined as the emerging and expanding capacities of the individual to provide progressively greater facility in functioning. The main areas of development are physical, motor, social, emotional, language and cognitive (Hurlock, 1978). Since the teacher's evaluation on a child's developmental status can be counted upon for its reliability, the teacher's assessment was also included. The questionnaire prepared for this purpose was then given to the respective teachers.

The questionnaire was structured to include question on different aspects of development viz., physical, motor emotional, social, language, intellectual and conceptual. Th maximum total score obtainable is 109 and the minimum score whic can be obtained is 0. The questionnaire and score sheet is give

in Appendix-VIII. Thus the total score of an individual respondent would vary from 0 - 109.

Unlike the case of other tools, assessment of only 210 sample were obtained. The assessment score of the Group V could not be obtained since their respective class teachers could not be contacted as they were from various schools in the district.

3.4 Statistical tools used

The following statistical tools were used for consolidation and analyses of data.

a. Frequency of percentage

Some of the data were subjected to and interpreted in terms of frequency and percentages.

b. Analysis of variance (ANOVA) was used for determining the variances of the different assessment scores among the 5 study groups ie Group I, Group II, Group III, Group IV, Group V.

c. Simple correlations (r) were computed to find out the relationship between the various independent variables and the dependent variables and also to study the inter-relationships among the various quantitative variables.

d. Chi square test was also used to find any significant relationship or association between some quantitative and independent variables.

For the convenience of statistical analysis. the data collected were grouped into dependent and independent variables.

The LD, intelligence, nutritional status and overall development assessment scores were considered as dependent variables. since. as per the review of literatures LD and nutritional status were found to be influenced by intelligence and overall development.

The variables which were expected. to have a relationship with the selected dependent variables were considered as independent variables. These variables were identified from demographic, socio economic, developmental, health, nutritional and dietary aspects of the sample.

RESULTS

4. RESULT

The break up of the sample based on the different study variables are presented first under various sections as given below. Further statistical analysis done to assess the impact and relationship if any between the independent and dependent variables are presented later on.

4.1 Demographic and socio-economic profile

4.2 Profile on developmental, health and nutritional status

4.3 Profile on dietary habits and food consumption pattern

4.4 Profile on learning disabilities, intelligence and overall development assessment scores

4.5 Comparison of learning disabilities, intelligence, nutritional status and overall development assessment scores among the groups

4.6 Correlation of learning disabilities, intelligence, nutritional status and overall development assessment scores between each other and with selected variables

4.7 Association of learning disability with selected variables

4.1 Demographic and socio economic profile

Socio economic and demographic characteristics have a profound impact on a child's nutritional and cognitive

development. The socio economic and demographic features of the sample that are relevant in terms of structure and composition are referred to as age. sex, religion, caste, place of residence, parents' educational and employment status, family type and size, number of siblings and order of birth.

4.1.1 Demographic profile

4.1.1.1 Age

Age of the subjects is an important yardstick in the selection of the sample. Age was measured as the number of completed years at the time of conduct of study and it ranged from five to ten years. Since equal number of children were selected from each class from first to fourth standard based on their achievement more or less same distribution was seen in all the groups (Table 4). But in the Vth group, the subjects were selected on the criterion of presence of LD in children between the age of five to ten years. Hence slight variation could be seen in the agewise distribution ie. 15 subjects out of 30 (50.00 per cent) in this group belonged to the age category of 9-10 years.

4.1.1.2 Sex

Sexwise distribution of the sample is revealed in Table (4). As can be observed. of the 240 subjects studied 122 (50.83 per cent) were boys and the rest 118 (49.17 per cent) were

girls. Except in Group V. all the other groups had more females than males ie in Group I. II and III. Out of 60 each there were 30 - 33 females (50.00 - 55.00 per cent). In Group V 26 out of 30 studied were males (86.67 per cent). This agrees with the findings of Marsh and Gearhart (1978) who brought to light the fact that learning disability was diagnosed, four to eight times more in boys than in girls. Thus making out the possibility of involvement of the sex genes.

4.1.1.3 Religion

As presented in Table 4, 183 subjects (76.25 per cent) of the 240 studied were Hindus followed by about 48 (20.00 per cent) Christians. Groupwise analysis revealed that in all the groups Hindus dominated except in Group IV where Christians were about 25 out of 30 studied (83.33 per cent). Group IV was identified from the coastal areas of Vizhinjam panchayat where a vast majority of the population are Christians. Since religion was not a criterion for sample selection, the sample comprised of random representation of the three major religion dominated by Hindus.

4.1.1.4 Caste

In Table 4. the details of castewise distribution of the groups is depicted. From the table, it is noticeable that the majority of the sample studied constituted of backward caste with only very few members from forward caste. The groupwise

distribution revealed the following. In the first three groups of 60 each. 24 (40.00 per cent) in Group I, 19 (31.67 per cent) in Group II and 29 (48.33 per cent) in Group III belonged to backward caste while in Group IV out of 30 subjects 27 (90.00 per cent) were from SC/ST category. Unlike the other four groups, in Group V 16 out of 30 (53.33 per cent) belonged to the forward caste. This impact of caste difference on the various study variables were analysed later on.

4.1.1.5 Place of residence

Further the localewise classification of the sample groups studied can be observed in the Table 4. Accordingly it can be seen that in Group III and IV all the children were from panchayat areas whereas the other three groups included representation from corporation also. When out of 60, 28 (46.67 per cent) consisted of children from Corporation area, the representation was 13 out of 60 in Group II (21.67 per cent) and 3 out of 30 in Group V (10.00 per cent). The representation from municipal area was very little that too only in two groups viz., in Group III out of 60 only one (1.67 per cent) and in Group V out of 30 only four (13.33 per cent). This unusual representation may be due to the fact that the study was concentrated more among rural subjects for want of malnourished cases.

Table 4

Groupwise distribution of sample based on demographic profile

Sl. No.	Demographic variables	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Age						
1.	≤ 6 years	6 (10.00)	7 (11.67)	9 (15.00)	7 (23.33)	2 (6.67)	31 (12.92)
2.	6.1-7 years	11 (18.33)	12 (20.00)	11 (18.33)	2 (06.67)	1 (3.33)	37 (15.42)
3.	7.1-8 years	14 (23.33)	13 (21.07)	15 (25.00)	4 (13.33)	3 (10.00)	49 (20.42)
4.	8.1-9 years	18 (30.00)	14 (23.33)	6 (10.00)	9 (30.00)	9 (30.00)	56 (23.33)
5.	> 9 years	11 (18.33)	14 (23.33)	19 (31.67)	8 (26.67)	15 (50.00)	67 (27.92)
2.	Sex						
1.	Male	27 (45.00)	28 (47.00)	29 (48.33)	12 (40.00)	26 (86.67)	122 (50.83)
2.	Female	33 (55.00)	32 (53.33)	31 (51.67)	18 (60.00)	4 (13.33)	118 (49.17)
3.	Religion						
1.	Hindu	47 (78.33)	47 (78.33)	58 (96.67)	5 (16.67)	26 (86.67)	183 (76.25)
2.	Christian	5 (08.33)	13 (21.67)	1 (01.67)	25 (83.33)	4 (13.33)	48 (20.00)
3.	Muslim	8 (13.33)	-	1 (01.67)	-	-	9 (03.75)

Table 4 continued

Sl. No.	Demographic variables	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240

4. Caste

1.	Forward	21 (35.00)	18 (30.00)	16 (26.67)	1 (03.33)	16 (53.33)	72 (30.00)
2.	OBC	24 (40.00)	19 (31.67)	29 (48.33)	2 (06.67)	12 (40.00)	86 (35.83)
3.	SC/ST	15 (25.00)	23 (38.33)	15 (25.00)	27 (90.00)	2 (06.67)	82 (34.17)

5. Place of residence

1.	Panchayat	32 (53.33)	46 (76.67)	60 (100)	30 (100)	23 (76.67)	191 (79.58)
2.	Municipality	–	1 (01.67)	–	–	4 (13.33)	5 (02.08)
3.	Corporation	28 (46.67)	13 (21.67)	–	–	3 (10.00)	44 (18.33)

4.1.2 Social profile

Under social profile the information concerning the structure. composition. education and employment characteristics of the subjects' family viz., parents and siblings are included.

4.1.2.1 Parents' Educational Status

The parental educational level (Table 5) of the subjects ranged from primary level to post graduation and technical education. The statistics revealed that majority of the fathers had high school education ie,, 95 out of 240 (39.58 per cent). Next to that about 62 (25.83 per cent) out of 240 had

upper primary education. Only 16 (6.67 per cent) were found to be graduates and only one person out of the whole sample had done his post graduation. About 18 out of 240 (ie., 7.05 per cent) had technial education. There were a few illiterate fathers too ie.,7 out of 240 (2.92 per cent). who did not know how to read or write.

Similarly in the case of mothers' education also, the literacy level ranged from primary school to post graduation. Most of them ie., 91 out of 240 (37.92 per cent) had high school education. Compared to fathers, more number of graudates and post graduates were among mothers. The number of illiterates are more or less the same. Interestingly not a single mother had technical education.

The groupwise distribution of the parent's educational status showed that in the case of Group V none were found to be illiterate. unlike the other groups. Also Group V showed the highest number of graduates ie.,9 out of the 30 fathers (30.00 per cent) and 10 out of 30 mothers (33.33 per cent). In the case of Group IV. equal number of fathers and mothers ie., 4 out of 30 each (13.33 per cent each) had completed their high school education. Moreover, none of the fathers as well as the mothers had gone beyond their high school in this group. This is to be specifically mentioned since it is an exception considering other groups.

Table 5
Groupwise distribution of sample based on the parent's educational status

Sl. No.	Educational levels	Father's Educational Status						Mother's Educational Status					
		Groups					Total	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240	G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Illiterate	1 (01.67)	1 (01.67)	2 (03.33)	3 (10.00)	–	7 (02.92)	–	2 (03.33)	4 (06.67)	2 (06.67)	–	8 (03.33)
2.	Lower primary	1 (01.67)	–	1 (01.67)	14 (46.57)	–	16 (06.67)	9 (15.00)	2 (03.33)	10 (16.67)	11 (36.67)	–	32 (13.33)
3.	Upper primary	22 (36.67)	11 (18.33)	16 (26.67)	9 (30.00)	4 (13.33)	62 (25.83)	7 (11.67)	13 (21.67)	16 (26.67)	16 (53.33)	4 (13.33)	56 (23.33)
4.	High School	28 (46.67)	27 (45.00)	30 (50.00)	4 (13.33)	6 (20.00)	95 (39.58)	39 (65.00)	23 (38.33)	24 (40.00)	1 (03.33)	4 (13.33)	91 (37.92)
5.	Technical	2 (03.33)	7 (11.67)	4 (06.67)	–	5 (16.67)	18 (07.50)	–	–	–	–	–	–
6.	Pre-degree	5 (08.33)	8 (13.33)	6 (10.00)	–	6 (20.00)	25 (10.42)	3 (05.00)	17 (28.33)	5 (08.33)	–	9 (30.00)	34 (14.17)
7.	Graduate	1 (01.67)	6 (10.00)	–	–	9 (30.00)	16 (06.67)	2 (03.33)	3 (05.00)	1 (01.67)	–	10 (33.33)	16 (06.67)
8.	Post-graduate	–	–	1 (01.67)	–	–	1 (00.42)	–	–	–	–	4 (10.00)	4 (01.67)

4.1.2.2 Parent's employment status

Further, the employment status of the parents were also studied.   As illustrated in Table 6,   among the total 240 subjects studied, the fathers of 117 subjects (48.75 per cent) were casual labourers.   In groupwise distribution also it could be noted that majority belonged to this category except for Group V where out of 30 subjects, 9 (30.00 per cent) had their fathers in government services.   The rural representation of this sample may be the reason. for high representation of labourers.

The statistics regarding mother's employment status gives a different picture, where out of 240, 182 (75.83 per cent) were unemployed mothers.   This was the case in all the groups ie about 70 to 80 per cent were unemployed.   But in group IV, of the 60 subjects,19(63.33 per cent) had their mothers engaged in some form of self employment.

Table 6
Groupwise distribution of sample based on their parent's employment Status

Sl. No.	Employment category	Father's Employment Status						Mother's Employment Status					
		Group					Total	Group					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240	G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Government	3 (05.00)	7 (11.67)	1 (01.67)	–	9 (30.00)	20 (08.33)	5 (08.33)	4 (06.67)	2 (03.33)	–	5 (16.67)	16 (06.67)
2.	Private	8 (13.33)	10 (16.67)	7 (11.67)	–	5 (16.67)	30 (12.50)	2 (03.33)	1 (01.67)	–	–	1 (03.33)	4 (01.67)
3.	Part time	–	2 (03.33)	2 (03.33)	–	1 (03.33)	5 (02.08)	1 (01.67)	–	2 (03.33)	–	–	3 (01.25)
4.	Casual Labourers	39 (65.00)	30 (50.00)	34 (56.67)	7 (23.33)	7 (23.33)	117 (48.75)	1 (01.67)	2 (03.33)	2 (03.33)	2 (06.75)	–	7 (02.92)
5.	Self employment	8 (13.33)	10 (16.67)	12 (20.00)	20 (66.67)	8 (26.67)	58 (24.17)	2 (03.33)	4 (06.67)	–	19 (63.33)	3 (10.00)	28 (11.67)
6.	Unemployment	2 (03.33)	1 (01.67)	4 (06.67)	3 (10.00)	–	10 (04.17)	49 (81.67)	49 (81.67)	54 (90.00)	9 (30.00)	21 (70.00)	182 (75.83)

4.1.2.3 Familial details

4.1.2.3.1 Family type

Family type is classified into joint, nuclear and extended based on the composition. Joint families include parents, children, grand parents and other relatives where as nuclear families have only parents and their children under one roof. The extended families in addition to parents and children have one or two relatives staying with them. On this basis the sample was again classified. Majority, ie, 146 subjects (60.83 per cent) belonged to nuclear families. Next to nuclear families 53 subjects (22.08 per cent) belonged to extended family system and the rest 41 (17.08 per cent) came from joint families. Similar trend could be noted in all the five sample groups as is evident in Table 7.

Today the concept of nuclear family is becoming more and more common in our society while joint family system is fast disappearing. In this study also the nuclear families dominated over joint and extended families. Predominance of nuclear family in the Trivandrum district has also been reported by Sadasivan et al. (1980). Suja (1989) and Lovely (1996). This may be the reason for the high representation of nuclear family in the present study. But it can be noted that joint or extended families are not completely absent.

4.1.2.3.2 Family size

Family size is an important factor which greatly influences the development of children in all respects (Devadas et al., 1980). Moreover, neglect and improper scholastic and intellectual stimulation to children with LD were reported from families of large size (NJCLD, 1987).

In this study, the subjects' family size were classified as 'small' (1-5 members), 'medium' (5-8 members) and 'large' (>8 members). Of the total subjects, 127 (52.92 per cent) came from small families. In all the five sample groups the trend of small family size was predominant. The remaining 103 subjects (42.92 per cent) belonged to medium family size and the rest 10 subjects (4.17 per cent) came from large families. Similar distribution can be seen in all the five groups (Table 7).

4.1.2.3.3 Number of Siblings

The number of siblings in the family has an influence on the development of children especially their social, emotional and intellectual development through sibling interaction (Hurlock, 1980). Hence the sibling constellation of the sample was also determined. Accordingly, the group wise distribution of sample based on the number of siblings has been featured in Table 7. It can be noted that majority of the 240 subjects studied ie. 147 (61.25 per cent) had only one sibling and 34

subjects (14.17 per cent) were found to be the only child in their family. Similar trend was also noted in all the five groups.

4.1.2.3.4 Order of birth

When the birth order of the subjects were taken 135 out 240 (56.25 per cent) were found to be first born and 74 (30.83 per cent) last born. Group wise distribution also showed more or less same trend. The low number of middle born may be due to the predominence of one or two children in small sized nuclear families (Table 7).

Table 7
Groupwise distribution of sample based on familial details

Sl. No.	Familial details	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	**Family type**						
1.	Nuclear	41 (68.33)	33 (55.00)	35 (58.33)	17 (56.67)	20 (66.67)	146 (60.83)
2.	Joint	9 (15.00)	11 (18.33)	12 (20.00)	6 (20.00)	3 (10.00)	41 (17.08)
3.	Extended	10 (16.67)	16 (27.00)	13 (21.67)	7 (23.33)	7 (23.33)	53 (22.08)
2.	**Family size**						
1.	Small	30 (50.00)	31 (51.67)	32 (53.33)	17 (56.67)	17 (56.67)	127 (52.92)
2.	Medium	28 (46.67)	28 (46.67)	22 (36.67)	13 (43.33)	12 (40.00)	103 (42.92)
3.	Large	2 (03.33)	1 (01.67)	6 (10.00)	-	1 (03.33)	10 (04.17)

Table 7 continued

Sl. No.	Familial details	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
3.	**Number of siblings**						
1.	None	16 (26.67)	10 (16.67)	5 (08.33)	1 (03.33)	2 (06.67)	34 (14.17)
2.	One	37 (61.67)	36 (60.00)	39 (65.00)	14 (46.67)	21 (70.00)	147 (61.25)
3.	Two	7 (11.67)	14 (23.33)	15 (25.00)	12 (40.00)	5 (16.67)	53 (22.08)
4.	Three	–	–	1 (01.67)	3 (10.00)	2 (06.67)	6 (02.50)
4.	**Order of birth**						
1.	First	35 (58.33)	34 (56.67)	39 (65.00)	14 (46.67)	13 (43.33)	135 (56.25)
2.	Middle	6 (10.00)	7 (11.67)	5 (08.33)	6 (20.00)	7 (23.33)	31 (12.92)
3.	Last	19 (32.67)	19 (31.67)	16 (26.67)	10 (33.33)	10 (33.33)	74 (30.83)
4.	Others	–	–	–	–	–	–

4.1.3 Economic profile

Kanwar et al. (1998) reported that the important determinant of child health is the socio economic status of the family especially income of the family. Hence it is inevitable to consider this aspect for the study.

The main features included under this parameter is the monthly income and expenditure pattern of the families of the

sample. A few other characteristics like living conditions are also included under this.

4.1.3.1 Monthly income

The subjects were first classified into 'low income group'. 'middle income group' and 'high income group' based on their monthly income. But since the distribution of middle income showed much variation from the rest two, it was again subdivided as 'lower middle income', 'middle income' and 'upper middle income'. Groupwise distribution based on the family income is shown in Table 8. The distribution showed that more than half of the total 240 subjects studied ie., 137 (57.00 per cent) belonged to the lower middle class ie., monthly income of Rs.2250-3500. Nearly 48 to 58 per cent of the total sample in group I, II, III and IV falls within the lower middle income group. Meanwhile in group IV the monthly income level of the whole sample ranged from Rs.2250 to 3500, viz., the low income and lower middle income category. Compared to the other groups, group V comprised of more subjects within the middle income group and upper middle income group within an income ranging from Rs.3500-5000 and Rs.5,001 - 10,000 respectively. Moreover, only this group had subjects from high income too showing that the variation in the group was more ranging from low to high with representation from all the income groups unlike the others.

Table 8

Groupwise distribution of sample based on Monthly Income

| Sl. No. | Income class | Income Range (Rs) | Groups | | | | | Total |
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Low income ≤	2250	5 (08.33)	6 (10.00)	6 (10.00)	4 (13.33)	2 (06.67)	23 (09.58)
2.	Lower middle income	2251- 3500	29 (48.33)	34 (56.67)	41 (68.33)	26 (86.67)	7 (23.33)	137 (57.08)
3.	Middle income	3501- 5000	18 (30.00)	11 (18.33)	8 (13.33)	-	10 (33.33)	47 (19.58)
4.	Upper middle income	5001- 10000	8 (13.33)	9 (15.00)	5 (08.33)	-	9 (30.00)	31 (12.92)
5.	High income	10001- 20000	-	-	-	-	2 (06.67)	2 (00.83)

4.1.3.2 Monthly expenditure pattern

Along with income status the monthly expenditure pattern especially on food, education and other items is an important determining factor in the social development, nutrition and educational status of the population. Monthly expenditure pattern of the families of the sample in different items like food. clothing. housing. travelling, education, entertainment, health-care. miscellaneous and savings are presented in Table 9.

It is clear from the data that every family studied spend relatively more on food while the rest of the money was spent on non-food items. Nearly 98 per cent of the sample studied spent about Rs.500 or more on their food irrespective of the variations in their income level. Only 4 (1.67 per cent) out

of the total 240 spent less than Rs.500 per month on food. Whereas 118 (49.17 per cent) spent between Rs.500-1000 and 118 (49.17 per cent) spend above Rs.1,000 per month.

As far as expenditure on non food items were concerned, it is interesting to note that expenditure on education and health-care comes next to food in all the groups irrespective of their income level. 142 (59.17 per cent) of the whole sample spent between Rs.100 to 500 per month on education. When individual groups were taken, the variation ranged from 53.33 per cent to 78.33 per cent except in group IV where only 3 out of 30 (10.00 per cent) fell in this category. 27 (90.00 per cent) of the group spent only Rs.100 per month for education. This is not very less when compared to their monthly income as majority of the group fell within the lower middle income category ranging from Rs.2,250-3,500.

It could be observed that almost similar amount is spent on health-care also by the majority ie.,162 (67.05 per cent) out of 240. Irrespective of the income level the group wise expenditure ranged from 60-70 per cent. It can be noticed that even the high income Group V, spent much less compared to other groups.

Another interesting revelation is that majority of the sample ie., 60-70 per cent in all the groups spent only Rs.100 or less for other items like clothing, housing and travelling. It

also indicated that the expenditure on entertainment is very low ie below Rs.100 by the absolute majority (more than 80.00 per cent) in all the five groups.

As could be seen that the income spent on miscellaneous items fell between Rs.500 to 1,000. . for about 47.92 per cent of the sample and above Rs.1000 for 19.17 per cent of the sample. Here groupwise variation is more compared to other items. Much variation was indicated in Group I where for 16 out of 60 (26.67 per cent), the expenditure was between Rs. 500-1000 while for 36 .60.00 per cent) subjects it was between Rs.100-500. Surprisingly. savings level also showed similar trend .rrespective of group differences or income variations. 132 out of 240 (55.00 per cent) could save only less than Rs.100 per month whereas 40.00 to 60.00 per cent of Group II, III and V had savings between Rs.100-500. But here also slight variation is seen in Group I where 37 out of 60 (61.67 per cent) had savings between Rs.100-500. The families of the whole sample studied had some savings even if it was as little as Rs.100 or less per month.

Table 9

Groupwise distribution of sample based on expenditure pattern

Sl. No.	Items	Expenditure range (in rupees)	Groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Food	100 - 500	2 (03.33)	2 (03.33)	-	-	-	4 (01.67)
		501-1000	39 (65.00)	35 (58.33)	18 (30.00)	17 (56.67)	9 (30.00)	118 (49.17)
		> 1000	19 (31.67)	23 (38.33)	42 (70.00)	13 (43.33)	21 (70.00)	118 (49.17)
2.	Clothing	≤ 100	37 (61.67)	36 (60.00)	47 (78.33)	30 (100.00)	22 (73.33)	172 (71.67)
		100 - 500	22 (36.67)	24 (40.00)	13 (21.67)	-	8 (26.67)	67 (27.92)
		501-1000	1 (01.67)	-	-	-	-	1 (00.42)
3.	Housing	≤ 100	37 (61.67)	40 (66.67)	47 (78.33)	30 (100.00)	5 (16.67)	159 (66.25)
		100 - 500	22 (36.67)	16 (26.67)	6 (10.00)	-	15 (50.00)	59 (24.58)
		501-1000	1 (01.67)	3 (05.00)	7 (11.67)	-	7 (23.33)	18 (07.50)
		> 1000	-	1 (01.67)	-	-	3 (10.00)	4 (01.67)
4.	Traveling	≤ 100	31 (51.67)	33 (55.00)	33 (55.00)	21 (70.00)	9 (30.00)	127 (52.92)
		100 - 500	28 (46.67)	26 (43.33)	25 (41.67)	9 (30.00)	16 (53.33)	104 (43.33)
		501-1000	1 (01.67)	1 (01.67)	2 (03.33)	-	5 (16.67)	9 (03.75)

Table 9 continued

Sl. No.	Items	Expenditure range (in rupees)	G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	Total n=240
5.	Education	≤ 100	15 (25.00)	12 (20.00)	22 (36.67)	27 (90.00)	3 (10.00)	79 (32.92)
		100 - 500	41 (68.33)	47 (78.33)	32 (53.33)	3 (10.00)	19 (63.33)	142 (59.17)
		501-1000	4 (06.67)	1 (01.67)	6 (10.00)	-	8 (26.67)	19 (07.92)
6.	Entertainment	≤ 100	51 (85.00)	33 (88.33)	53 (88.33)	30 (100.00)	24 (80.00)	211 (87.92)
		100 - 500	9 (15.00)	7 (11.67)	7 (11.67)	-	6 (20.00)	29 (12.08)
7.	Health care	≤ 100	18 (30.00)	17 (28.33)	18 (30.00)	9 (30.00)	1 (03.33)	63 (26.25)
		100 - 500	41 (68.33)	41 (68.33)	41 (68.33)	21 (70.00)	18 (60.00)	162 (67.50)
		501-1000	1 (01.67)	2 (03.33)	1 (01.67)	-	10 (33.33)	14 (05.83)
		> 1000	-	-	-	-	1 (03.33)	1 (00.42)
8.	Miscellaneous	≤ 100	5 (08.33)	4 (06.67)	3 (05.00)	-	2 (06.67)	14 (05.83)
		100 - 500	36 (60.00)	9 (15.00)	15 (25.00)	4 (13.33)	1 (03.33)	65 (27.08)
		501-1000	16 (26.67)	39 (65.00)	31 (51.67)	16 (53.33)	13 (43.33)	115 (47.92)
		> 1000	3 (05.00)	8 (13.33)	11 (18.33)	10 (33.33)	14 (46.67)	46 (19.17)
9.	Savings	≤ 100	19 (31.67)	32 (53.33)	36 (60.00)	30 (100.00)	15 (50.00)	132 (55.00)
		100 - 500	37 (61.67)	26 (43.33)	24 (40.00)	-	13 (43.33)	100 (41.67)
		501-1000	4 (06.67)	2 (03.33)	-	-	2 (06.67)	8 (03.33)

4.1.3.3 Living conditions

Details regarding the existing housing facilities (Table 10) were collected to assess the living conditions of the sample. The parameters included were type of houses, availability of basic facilities and luxuries. Development of basic facilities related to habitation in a community is a visible expression of poverty. Majority of the population coming under low income group were residing in unhygienic conditions, in katcha habitats or small houses and physical environment deprived of amenities like water, electricity and facilities for waste disposal besides poor sanitation and lack of space.

4.1.3.3a Type of house

As indicated in Table 10, about 40.00 - 50.00 per cent of the sample in all the four groups especially Group I, II, III and IV lived in their own houses but with thatched roofs. In Group IV, the majority ie, 28 out of 30 (93.33 per cent) dwelled in thatched houses owned by them. In the case of Group V, the trend varied from all the other groups. About 21 out of 30 (70.00 per cent) of the subjects in this group owned concrete houses and about 6 subjects (20.00 per cent) lived in own tiled houses. Those dwelling in thatched houses revealed that majority of the sample ie. about 217 (90.42 per cent) owned houses of their own whether thatched or tiled or concrete. Only very few from the Groups I and II lived in rented houses.

4.1.3.3b   Necessities available

This list of information was assessed considering the availability of water. electricity and latrine facilities, either all or at least any one or two of them.   Accordingly, the groupwise distribution of the necessities owned by the families of the subjects were worked out (Table 10).   And it could be made out from the table that   in all the groups except for Group IV, majority had all these facilities ie, 38 (63.33 per cent) in Group I. 41 (68.33 per cent) in Group II, 31 (51.67 per cent) in Group III and 25 (83.33 per cent) in Group V.   However, subjects in Group IV were found deprived of these three facilities.

4.1.3.3c   Conveniences available

The conveniences available were accounted by taking into consideration availability of facilities like radio, television, newspaper, refrigerator and gas stove.   The groupwise distribution of this aspect is detailed in Table 10.   From the table it is evident that Group V is the only one where 7 out of 30 (23.33 per cent) had more than ten items of conveniences.   In Group I more than half ie 31 out of 60 (51.67 per cent) had no more than 2 types of conveniences.   In Group II and III 21 out of 60 (35.00 per cent) and 32 out of 60 (53.33 per cent) respectively   had 2-4 items of conveniences.

Table 10

Groupwise distribution of samples based on living conditions

Sl. No.	Living conditions	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240

1. Type of house

1.	Rented thatched	5 (08.33)	–	–	–	1 (03.33)	6 (02.65)
2.	Rented tiled	8 (13.33)	2 (03.33)	–	–	–	10 (04.17)
3.	Rented concrete	1 (01.67)	4 (06.67)	1 (01.67)	–	1 (03.33)	7 (02.92)
4.	Own thatched	26 (43.33)	26 (43.33)	30 (50.00)	28 (93.33)	1 (03.33)	111 (46.25)
5.	Own tiled	17 (28.33)	20 (33.33)	20 (33.33)	2 (06.67)	6 (20.00)	65 (27.08)
6.	Own concrete	3 (05.00)	8 (13.33)	3 (15.00)	–	21 (70.00)	41 (17.08)

2. Necessities available

1.	None	2 (03.33)	1 (01.67)	2 (03.33)	8 (26.67)	–	13 (05.42)
2.	Only one	1 (01.67)	1 (01.67)	8 (13.33)	10 (33.33)	2 (06.67)	22 (09.17)
3.	Only two	19 (31.67)	17 (28.33)	19 (31.67)	12 (40.00)	3 (10.00)	70 (29.17)
4.	All three	38 (63.33)	41 (68.33)	31 (51.67)	–	25 (83.33)	135 (56.25)

Table 10 continued

Sl. No.	Living conditions	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240

3. Conveniences (in number)

1.	≤ 2	31 (51.67)	13 (21.67)	16 (26.67)	16 (53.33)	6 (20.00)	82 (34.16)
2.	2 - 4	21 (35.00)	21 (35.00)	32 (53.33)	14 (46.67)	4 (13.33)	92 (38.33)
3.	4 - 6	5 (08.33)	19 (31.67)	9 (15.00)	-	2 (06.67)	35 (14.58)
4.	6 - 8	3 (05.00)	4 (06.67)	3 (05.00)	-	9 (30.00)	19 (07.92)
5.	8 - 10	3 (05.00)	-	-	-	2 (06.67)	5 (02.08)
2.	≥ 10	-	-	-	-	7 (23.33)	7 (02.92)

4.2 Profile on developmental, health and nutritional status

In order to understand the health and nutritional profile of the sample, the subjects' early developmental profile, health history and feeding pattern were collected along with the present anthropometry, clinical features and dietary factors.

4.2.1 Developmental profile

The details pertaining to the developmental profile of all the subjects collected were related to both physical and psychological development and their early feeding pattern.

4.2.1.1 Physical development profile

The attributes regarding physical development were birth weight. term of delivery. duration of breast feeding and bottle feeding, history of immunisation and illness. The groupwise distribution of each of these aspects are sketched as follows.

4.2.1.1a Birth weight

The birth weights of the subjects as recalled by the mothers were recorded and were classified into four groups based on weight in Kilograms, viz., 'very low' ($\leq$1.5), 'low'. (1.5 - 2.5 kg). 'normal' (2.5 - 3.7 kg) and 'above normal' (> 3.7 kg) as explained by Ghai (1998).

The distribution of the subjects in each study group classified according to their birth weight is presented in Table 11. Accordingly it could be seen that 134 (55.42 per cent) out of 240. belonged to normal weight category. Only 2 out of the total 240 subjects (0.83 per cent) were above normal and 1 (0.04 per cent) with very low birth weight. All the others ie. 105 (43.75 per cent) out of the total, belonged to low birth weight category. This shows that almost half of the subjects were born with low birth weight. And low birth weight is considered as an important risk factor that affects normal development in children. In the case of groupwise distribution it could be observed that 39 out of 60 (65.00 per cent) in Group I, 37 out of

60 (61.67 per cent) in Group II and 22 out of 30 (73.33 per cent) in Group V had normal birth weight, whereas more than half in Group III and IV ie, 35 out of 60 (58.33) and 20 out of 30 (66.17 per cent) respectively had low birth weight.

4.2.1.1b Term of birth

In order to see whether the term of birth has any influence on the child's achievement level, this was also included as variable (Table 11). Among the total subjects studied majority ie, 217 (90.42 per cent) were born as full term babies and only the remaining 23 (9.58 per cent) were born as premature. Among the five groups studied, Group III and V had larger percentage of premature born subjects ie, 8 out of 60 (13.33 per cent) and 6 out of 30 (20.00 per cent) respectively.

4.2.1.1c Type of delivery

While probing the birth and developmental history of the subjects under study, the type of delivery of the children were also considered. 198 (82.50 per cent) out of 240 subjects were found to be born of normal delivery procedure while 30 (12.50 per cent) were born of caesarian section. In all the five groups, majority ie, 50 out of 60 (83.33 per cent) in Group I, 52 (86.66 per cent) in Group II, 49 (81.67 per cent) in Group III, 27 out of 30 (90.00 per cent) in Group IV and 20 (66.67 per cent) in Group V were born of normal delivery (Table 11).

4.2.1.1d Feeding history

(1) Breast feeding duration

The duration of breast feeding and bottle feeding were assessed of the five study groups inorder to assess the subjects early nutritional status. The groupwise distribution of the subjects based on period of breast feeding ranging from 12 months to 36 months and classified in one year interval is presented in Table 11. Accordingly, 86 out of 240 subjects (35.83 per cent) studied were breast feeding up to 24 months. Only 2 out of the total sample (0.83 per cent) were found not to be breast-fed. The groupwise distribution revealed that in Group I and V. the period of breast feeding was of longer duration in about 26 out of 60 (43.33 per cent) and 12 out of 30 (40.00 per cent). respectively. But as presumed in Group IV, consisting of malnourished children, the period of breast feeding in 13 out of 30 (43.33 per cent)) were of shorter duration ie, only upto 12 months.

ii) Bottle feeding duration

The split up of the sample based on the period of bottle feeding showed that (Table 11) the duration ranged from 12 months to 36 months. About 90 out of 240 (37.50 per cent) were not given bottle milk at all. The groupwise distribution was more or less similar in all the five groups where more than 25 per cent in each group were not bottle fed. One out of

30 (3.33 per cent) in Group V, 4 out of 60 (6.67 per cent) in Group II and 2 out of 60 (3.33 per cent) in Group III were bottle fed for more than 36 months.

4.2.1.1e Immunisation history

Immunisation from major killer diseases in childhood is highly essential to safeguard health and nutritional status of children. Hence the immunisation schedule followed for all the subjects were collected from the parents. It could be noticed that out of the whole sample 232 (97.08 per cent) had taken all the doses and as far as the groups were concerned, majority in all the groups were found to have completed all the immunisation schedule (Table 11). Meanwhile in Group V all the 30 (100.00 per cent) studied had taken all immunisation vaccines.

4.2.1.1f Illness history

A record of incidences of some of the common childhood diseases like. measles, mumps, diarrhoea, dysentry, jaundice, chickenpox, worm infestations and other serious illnesses, incidences of any accidents or history of any surgeries were collected from mothers of the subjects. The details thus obtained are consolidated and presented in Table 11.

In almost all the groups except for Group IV, mostly ie 22 out of 60 (36.67 per cent) in Group I, 23 out of 60 (38.33 per cent) in Group II, 25 (41.67 per cent) in Group III and

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13 out of 60 (43.33 per cent) in Group V had at least one incidence of a disease. But in Group IV ie,$\underset{\wedge}{in}$the malnourished group the occurrance of such incidents (two to three diseases) were observed in 11 out of 30 (36.67 per cent).

It was also observed that among the various childhood illnesses, measles was most commonly seen among this study group. Of the 240 studied, 80 (33.33 per cent) had incidence of measles and 65 (27.08 per cent) suffered from worm infestations and 52 (21.67 per cent) from mumps. Some of the serious illnesses like hyperthyroidism, meningitis, hypogonadism, epilepsy etch were noted in Group V. Among the 30 studied 3 in Group V (10.00 per cent) suffered from epileptic disorders and 5 (16.67 per cent) had delayed milestones and no birth cry.

Table 11

Groupwise distribution of sample based on
physical development profile

| Sl. No. | Physical development profile | Groups | | | | | Total |
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Birth weight (kg)						
1.	Low (1.5 - 2.5)	20 (33.33)	23 (38.33)	35 (58.33)	20 (66.67)	7 (23.33)	105 (43.75)
2.	Normal (2.5 - 3.75)	39 (65.00)	37 (61.67)	25 (41.67)	10 (33.33)	22 (73.33)	133 (55.42)
3.	Above normal >3.75	1 (01.67)	-	-	-	1 (03.33)	2 (00.83)

Table 11 continued

Sl. No.	Physical development profile	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
2.	**Term of delivery**						
1.	Normal	57 (95.00)	57 (95.00)	52 (86.67)	27 (90.00)	24 (80.00)	217 (90.42)
2.	Premature	3 (05.00)	3 (05.00)	8 (13.33)	3 (10.00)	6 (20.00)	23 (09.58)
3.	**Type of delivery**						
1.	Normal	50 (83.33)	52 (86.67)	49 (81.67)	27 (90.00)	20 (66.67)	198 (82.50)
2.	Caesarean	8 (13.33)	5 (08.33)	9 (15.00)	2 (06.67)	6 (20.00)	30 (12.50)
3.	Forceps	1 (01.67)	3 (05.00)	2 (03.33)	1 (03.33)	1 (03.33)	8 (03.33)
4.	Vaccum	1 (01.67)	–	–	–	3 (10.00)	4 (01.67)
4.	**Feeding history**						
4.1	**Breast feeding duration (in months)**						
1.	Nil	–	1 (01.67)	–	–	1 (03.33)	2 (00.83)
2.	≤ 12	9 (15.00)	13 (21.67)	20 (33.33)	13 (43.33)	10 (33.33)	65 (27.08)
3.	12.1 - 24.1	24 (40.00)	25 (41.67)	22 (36.67)	8 (26.67)	7 (23.33)	86 (35.83)
4.	24.1 - 36.1	26 (43.33)	18 (30.00)	15 (25.00)	9 (30.00)	12 (40.00)	80 (33.33)
5.	> 36.1	1 (01.67)	3 (05.00)	3 (05.00)	–	–	7 (02.92)

Table 11 continued

Sl. No.	Physical development profile	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240

4.2 Bottle feeding duration (in months)

Sl. No.		G. I	G. II	G. III	G.IV	G.V	Total
1.	Nil	33 (55.00)	20 (33.33)	19 (31.67)	10 (33.33)	8 (26.67)	90 (37.50)
2.	≤ 12	12 (20.00)	16 (26.67)	16 (26.67)	5 (16.67)	4 (13.33)	53 (22.08)
3.	12 - 24	9 (15.00)	17 (28.33)	19 (31.67)	12 (40.00)	7 (23.33)	64 (26.67)
4.	24 - 36	6 (10.00)	3 (05.00)	4 (06.67)	3 (10.00)	10 (33.33)	26 (10.83)
5.	> 36	-	4 (06.67)	2 (03.33)	-	1 (03.33)	7 (02.92)

5. Immunisation history

Sl. No.		G. I	G. II	G. III	G.IV	G.V	Total
1.	All taken	58 (96.67)	59 (98.33)	58 (96.67)	28 (93.33)	30 (100.00)	233 (97.08)
2.	Any missed	2 (03.33)	1 (01.67)	2 (03.33)	2 (06.67)	-	7 (02.92)

6. Number of illness

Sl. No.		G. I	G. II	G. III	G.IV	G.V	Total
1.	None	17 (28.33)	15 (25.00)	10 (16.67)	1 (03.33)	4 (13.33)	47 (19.58)
2.	Any one	22 (36.67)	23 (38.33)	25 (41.67)	3 (10.00)	13 (43.33)	56 (35.83)
3.	Any two	16 (26.67)	17 (28.33)	20 (33.33)	11 (36.67)	20 (40.00)	76 (31.67)
4.	Any three	5 (08.33)	5 (08.33)	5 (08.33)	11 (36.67)	-	26 (10.83)
5.	Any four	-	-	-	4 (13.33)	1 (03.33)	5 (02.08)

4.2.1.2 Psychological development profile

Psychological disturbances can be an indication of any physical and environmental disharmony in a child's life Developmental and behaviourable problems of the subjects were studied in detail to understand the psychological development profile.

4.2.1.2a Details on developmental problems

The details regarding the developmental problems seer in children during their early developmental years as in social, emotional, academic and sleep were made. Accordingly it was observed that in Group V all the subjects were with one or other developmental defects. 19 out of 30 (63.33 per cent) in this group had at least three developmental problems. Similarly all the subjects in Group IV also had some or other developmental problems. About 12 out of 30 (40.00 per cent) in this group had at least two problems. But in Groups I, II and III the mothers reported that no such incidences were observed till date among 58 (96.67 per cent) subjects in Group I, 50 (83.33 per cent) in Group II and 21 (35.00 per cent) in Group III. The details of groupwise distribution are given in Table 12.

4.2.1.2b Details on behavioural problems

The presence of behavioural problems commonly seen in children such as nail biting, bed wetting, temper tantrums, thumb

sucking and peer fights were recorded and the results thus obtained is presented in Table 12.

As revealed in the table more than half the subjects in Group I ie., 44 out of 60 (73.33 per cent), 37 (61.67 per cent), in Group II, 33 (55.00 per cent) in Group III and 17 out of 30 (56.67 per cent) in Group IV showed no such behavioural problems. In Group V also 12 out of 30 (40.00 per cent) reportedly showed none of these problems. Considering the whole study group, 143 (59.58 per cent) fell in this category.

Table 12

Groupwise distribution of sample based on psychological development profile

Sl. No.	Psychological development profile	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Number of developmental problems						
1.	None	58 (96.67)	50 (83.33)	21 (35.00)	–	–	129 (53.75)
2.	Any one	2 (03.33)	4 (06.67)	14 (23.33)	–	–	20 (08.33)
3.	Any two	–	3 (05.00)	15 (25.00)	12 (40.00)	–	30 (12.50)
4.	Any three	–	3 (05.00)	10 (16.67)	11 (36.67)	19 (63.33)	42 (17.50)
5.	Any four	–	–	–	6 (20.00)	4 (13.33)	10 (04.17)
6.	Any five	–	–	–	1 (03.33)	6 (20.00)	8 (03.33)
7.	All present	–	–	–	–	1 (03.33)	1 (00.42)

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Table 12 continued

Sl. No.	Psychological development profile	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240

2. Number of behavioural problems

1.	None	44 (73.33)	37 (61.67)	33 (55.00)	17 (56.67)	12 (40.00)	143 (59.58)
2.	Any one	14 (23.33)	22 (36.67)	23 (38.33)	10 (33.33)	11 (36.67)	80 (33.33)
3.	Any two	2 (03.33)	1 (01.67)	4 (06.67)	3 (10.00)	4 (13.33)	14 (05.83)
4.	Any three	-	-	-	-	3 (10.00)	3 (01.25)

4.2.2 Details on health and nutritional status

The present health and nutritional status of the subjects were assessed by taking into account their anthropometric measurements, ie, weight and height, as well as clinical symptoms. The level of malnutrition or the nutritional status were further assessed as per Gomez classification of weight for age.

4.2.2.1 Anthropometric measurements
4.2.2.1a Weight for age

Sexwise distribution of the mean weight for age profile of the sample is presented in Table 13 in comparison with the international (NCHS, 1990) and national (Vijayaraghavan, 1971) standards.

As per the table, it is evident that irrespective of the sex the average weight of each age group ie, the whole 240 subjects were lower when compared to the national as well as international standards.(Figure 1 and 2)

Table 13

Mean weight for age profile of the sample

Age (in years)	Boys				Girls			
	Sample size	Observed average weight (kg)	National standard (kg)	Inter- national standard (kg)	Sample size	Observed average weight (kg)	National standard (kg)	Inter- national standard (kg)
5	21	17.6	19.2	19.2	15	16.5	18.6	18.1
6	30	18.5	21.9	21.2	19	17.8	20.5	20.0
7	10	19.4	24.2	23.4	21	20.1	23.7	22.5
8	21	23.5	26.0	25.8	29	22.1	26.0	25.7
9	32	23.6	29.2	28.8	29	23.0	29.0	29.5
10	8	28.5	31.0	31.4	5	24.1	32.5	32.5

4.2.2.1b Height for age

Similar to the weight, the mean height for age of the subjects were also studied in comparison with the national as well as international standards as presented in Table 14.

As per the table, it was noted that both in the case of boys and girls at the age of five, their height is upto the national and international standards or more. When the national standard for five years old, is 112 cm for boys and 112.5 cm for girls, the mean height of the sample was 114.4 for boys and 112.5 for girls. In both cases, it is higher than the expected standards. But after the age of five, the mean height has started falling below the national and international standard for both the sexes (Figure 3 and 4).

Table 14
Mean height for age profile of the sample

Age (in years)	Boys				Girls			
	Sample size	Observed average height (cm)	National standard (cm)	International standard (cm)	Sample size	Observed average height (cm)	National standard (cm)	International standard (cm)
5	21	114.4	112.0	115.5	15	112.5	112.5	110.0
6	30	115.4	118.9	117.5	19	116.4	117.8	116.1
7	10	119.1	123.2	123.0	21	120.1	123.2	122.0
8	21	124.5	127.8	128.3	29	125.8	127.2	127.8
9	32	128.2	133.3	132.2	29	128.0	132.5	132.2
10	8	133.3	138.0	137.5	5	131.0	138.2	138.3

The weight for age data was further used to categorise the subjects into different grades of malnutrition following the Gomez classification. The details accordingly are presented in Table 14.

The groupwise distribution of the subjects' current nutritional status as per Gomez classification revealed that except in Group II and III there were no cases of severe malnutrition among the subjects in other groups (Table 15). There were two cases (3.33 per cent) in Group II and one ca: (1.67 per cent) in Group III out of 60 each. And except ; Group V all other groups had cases of moderate malnutrition. ; Group IV out of 30 not a single subject was seen to have norma nutritional status but had mild to moderate degrees r_

Figure-1

Weight for age distribution of boys in comparison with standards
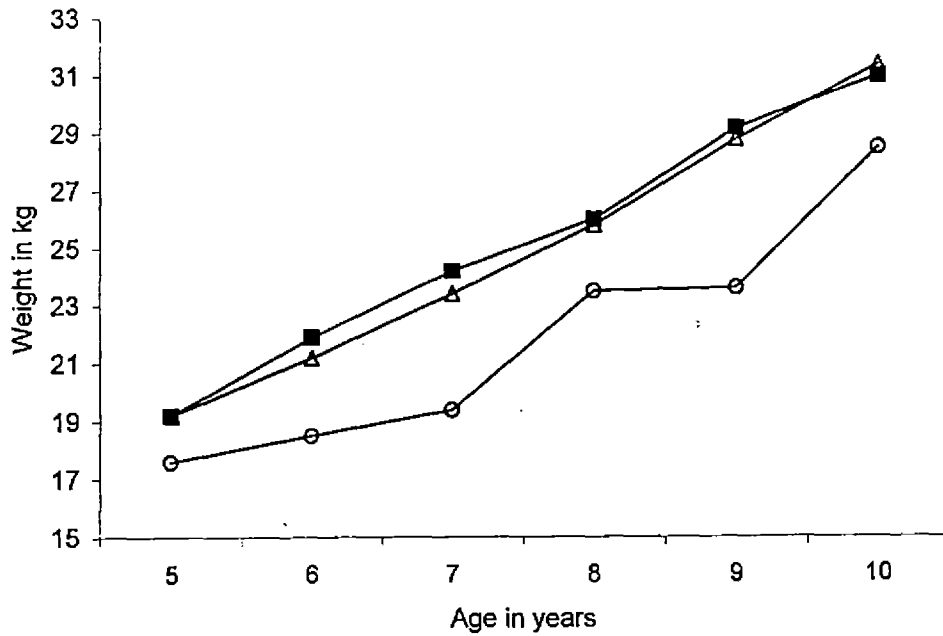
Figure-2

Weight for age distribution of girls in comparison with standards
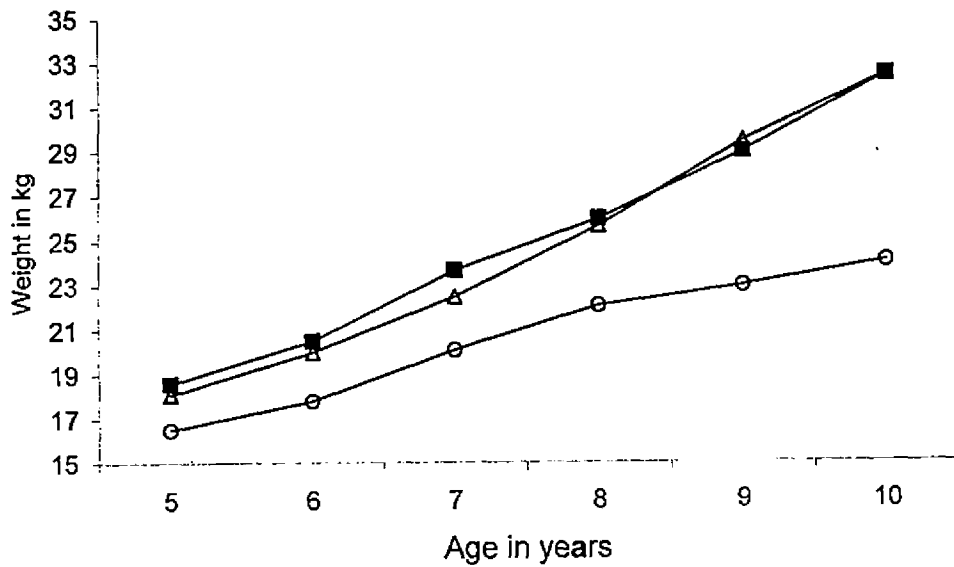
—⊖— Observed average weight (kg)

—■— National standard (kg)

—△— International standard (kg)

Figure-3

Height for age distribution of boys in comparison with standards
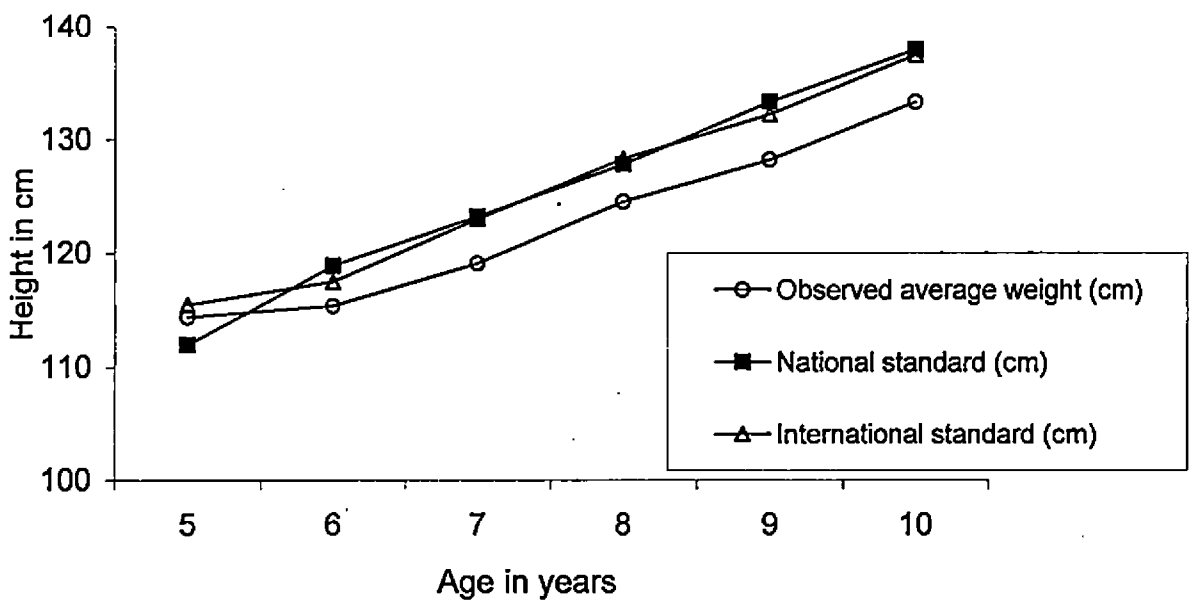
Figure-4

Height for age distribution of girls in comparison with standards
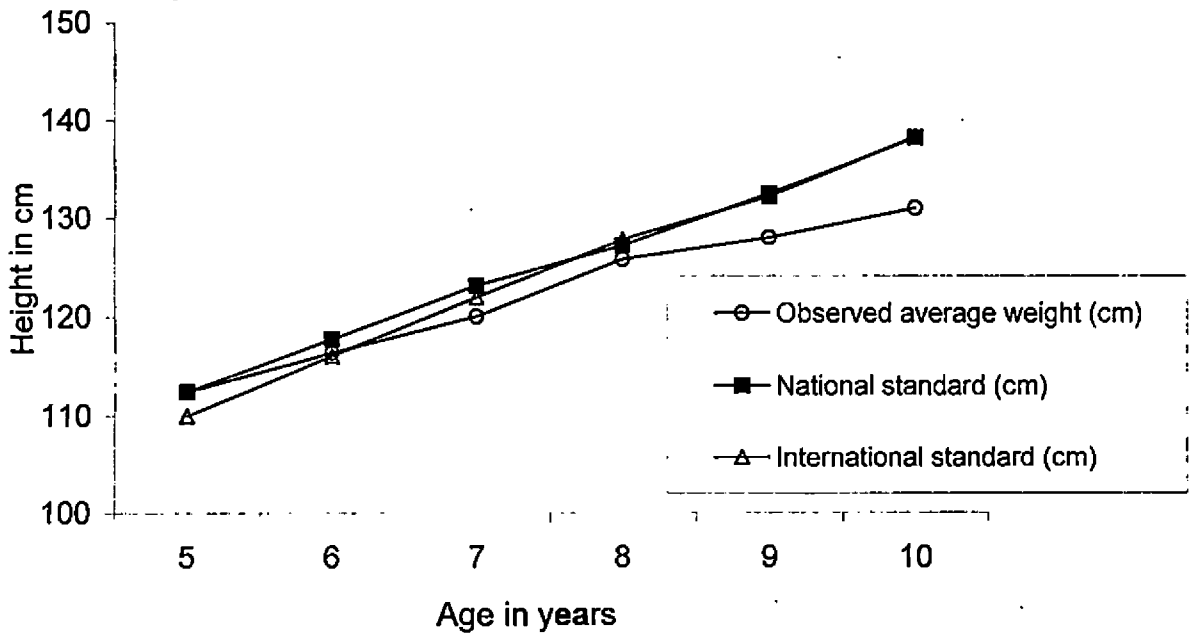
malnutrition ie., about 20 subjects (66.67 per cent) had mild degrees of malnutrition and 10 subjects (33.33per cent) had the same condition in moderate degrees. Surprisingly, in Group V except for 7 subjects (23.33 per cent) having mild degrees of malnutrition, all the others were with normal nutritional status. Thus in all, out of the 240 subjects studied 116 (48.33 per cent) were noted to be mildly malnourished (Figure-5).

Table 15

Groupwise distribution of weight for age classification
of the sample

Sl. No.	Gomez classi- fication	Groups					Total
		G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Normal	18 (30.00)	14 (23.33)	12 (20.00)	–	23 (76.67)	67 (27.92)
2.	Mild	30 (50.00)	33 (55.00)	26 (43.33)	20 (66.67)	7 (23.33)	116 (48.33)
3.	Moderate	12 (20.00)	11 (18.33)	21 (35.00)	10 (33.33)	–	54 (22.50)
4.	Severe	–	2 (03.33)	1 (01.67)	–	–	3 (01.25)

4.2.2.2 Clinical assessment

Apart from the above indicators, prevalence of major nutritional deficiency symptoms were identified through clinical examination also to detect the nutritional status of the subjects. The clinical status of all the subjects assessed by a general physician is presented in Table 16.

Figure 5

Level of Malnutrition based on Gomez-classification (Weight for age)
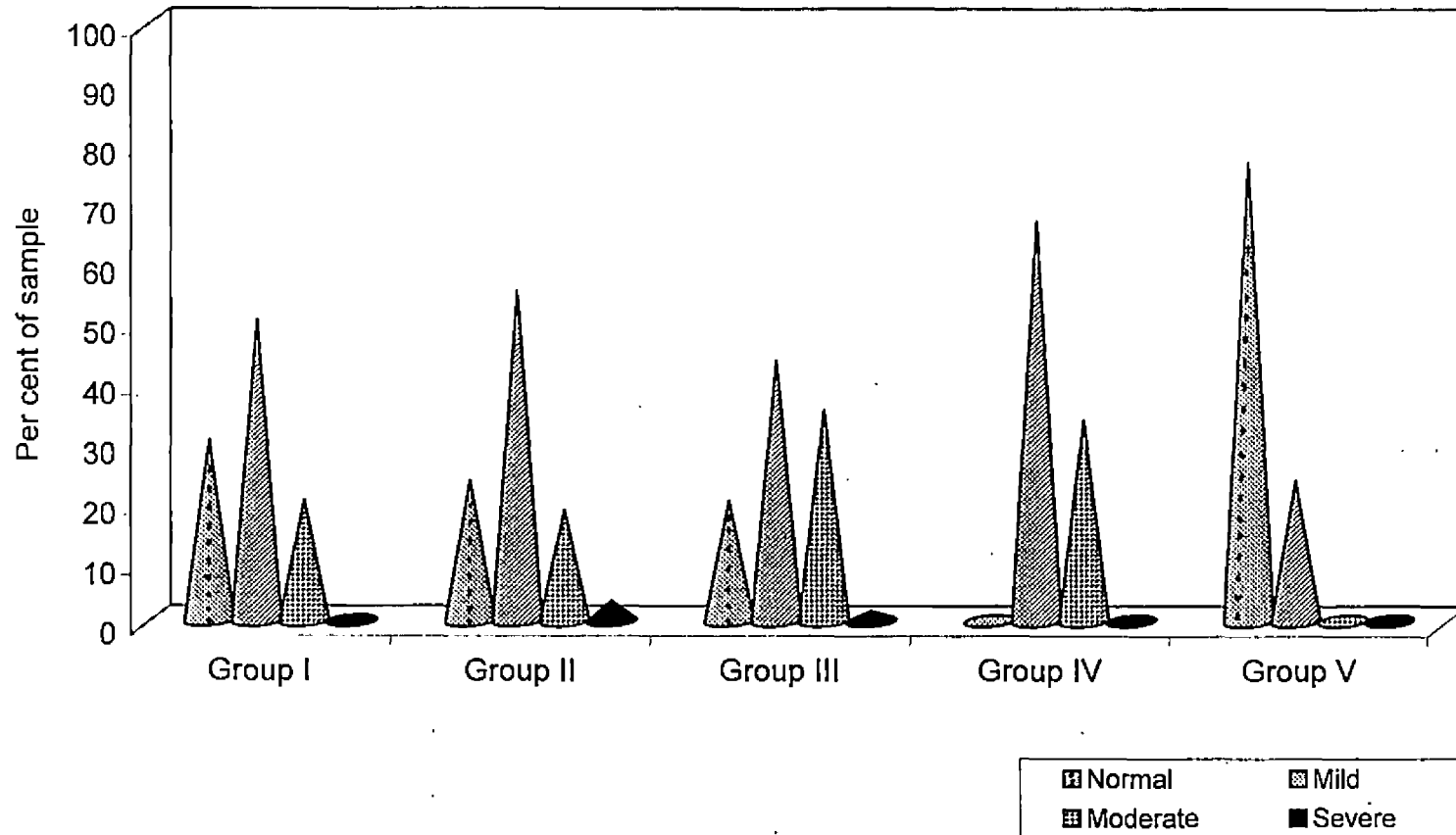
Accordingly the common deficiencies observed among the subjects were anaemia in 74 subjects (30.83 per cent), bleeding gums in 30 (12.50 per cent) and mottled enamel in 29 (12.08 per cent). Other deficiency symptoms seen were de-pigmentation of skin in 4 subjects (1.67 per cent), angular stomatitis in 11 subjects (4.58 per cent), nightblindness in 4 (1.67 per cent) and thyroid enlargement in 3 subjects (1.25 per cent).

The groupwise analysis in the table further indicated that Group IV had more cases of deficiency symptoms compared to other groups. Especially anaemia was seen in majority ie, 23 (76.67 per cent) of the group. Apart from Group IV, consisting of malnourished group, Group III had more cases of clinical malnutrition followed by Group II. In Group I, the prevalence of clinical features was very few except for, cases of anaemia in 9 subjects (15.00 per cent), mottled enamel in 3 (5.00 per cent) and one case of nightblindness (1.67 per cent). Another interesting observation revealed was that, in Group V, comprised of LD children, the prevalence of clinical symptom was very low. Just 5 each of those studied were found to be anaemic and with mottled enamel (ie. 16.67 per cent in each case).

non-vegetarians. In all the five groups, similar representation was observed (Table 17).

4.3.2 Frequency of meals per day

Since frequency of meals per day reflects the qualitative adequacy of the food taken by the children, this variable was included in the study of food consumption pattern. Accordingly, of the 240 subjects, 192 (80.00 per cent) were found to be in the habit of taking three meals per day. Similar distribution was seen in all the five study groups ie, in Group I 46 out of 60 (76.67 per cent) 52 (86.67 per cent) in Group II, 56 (93.33 per cent) in Group III, 20 (66.67 per cent) in Group IV and 18 (60.00 per cent) in Group V. In all the groups except in Group IV. the rest of the subjects were in the habit of taking four meals per day. But in Group IV comprising of malnourished children one third of the group had only two meals per day (Table 17).

4.3.3 Adequacy of diet

The qualitative adequacy of diet was assessed by considering the presence of all the five food groups in their diet for three consecutive days. The results in this light pointed out that. of the total 240 subjects, 117 (48.75 per cent) followed a dietary pattern that included foods from all the five groups. It could be assumed that the remaining 123 (51.25 per cent) consumed a diet which did not include representation of all the five food

4.3.4 Frequency of use of foods

The consumption level of different foods on the basis of frequency of use is illustrated in Table 18. As expected, the cereals occupied the first position in daily consumption category in about 227 subjects of the total sample (94.58 per cent). In this case there was not much inter-group variation that could be seen. Vegetables and milk and milk products occupied the next position in the daily consumption level ie., 150 each in both (62.50 per cent) but only 3 subjects each out of the total (1.25 per cent) consumed green leafy vegetables and meat daily, thus occupying the last position. Fish occupied third position with about 146 subjects out of the total 240 (60.83 per cent) and fruits the fourth with about 97 (40.42 per cent) consuming these daily.

Other protective foods like pulses and egg were consumed daily by only a small proportion of the subjects namely by about 8 (3.33 per cent) and 9 (3.75 per cent) respectively. But fats and oils, sugar and jaggery were consumed daily by the majority ie.,229 (95.42 per cent) and 224 (93.33 per cent) subjects. respectively. The daily consumption of beverages like tea, coffee etc. were also comparatively high ie., 151 out of 240 (62.92 per cent). Bakery items were also finding a place in the daily diet of quite a few ie., about 29 out of total (12.08 per cent) which is comparatively more than the daily consumption of roots and tubers in the diet ie., 28 out of total (11.67 per cent).

Inter group differences are not very remarkable in all the groups except in Group IV. The daily diet of the Group IV constituted of cereals in 63.33 per cent, roots and tubers in 10.00 per cent, vegetables in 23.33 per cent and fish in 56.67 per cent of the 30 subjects. But the consumption of other foods were very low that too occassionally. Roots and tubers and other vegetables occupy the next position in the diet of this group since 20 (66.67 per cent) and 19 (63.33 per cent) consumed it more than thrice per week respectively. It is interesting to note that consumption of bakery items are more in all the groups. Even in group IV about 23 (76.67 per cent) consumed it at least once per week and in others more than that. Only 5 out of 240 (2.08 per cent) were not seen to take it at all. In the case of other groups the consumption pattern is more or less similar. But the most surprising reveal was that there are many subjects who did not consume certain foods at all. For example a total of 10 (4.17 per cent) subjects did not take green leafy vegetables at all. This included all the groups except for Group V. Similarly 6 out of 240 (2.50 per cent) did not take fish at all. This also included all the groups except Group IV. Likewise in the consumption of egg also about 10 out of the total (4.17 per cent) were not in the habit of taking it as was seen in other groups except for Group IV. But all the groups consumed meat at least once per week. Further in Group I one each out of 60 (1.67 per cent) neither took roots and tubers nor beverages.

Table 18
Groupwise distribution of sample based on frequency of food use

Sl. No.	Food items	Category	Percentage of sample groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Cereals	Daily	60 (100.00)	60 (100.00)	60 (100.00)	19 (63.33)	28 (93.33)	227 (94.58)
		More than thrice/week	-	-	-	11 (36.67)	2 (06.67)	13 (05.42)
2.	Pulses	Daily	8 (13.33)	-	-	-	-	8 (03.33)
		More than thrice/week	31 (51.67)	37 (61.67)	40 (66.67)	10 (33.33)	20 (66.67)	138 (57.50)
		Once per week	21 (35.00)	23 (38.33)	20 (33.33)	20 (66.67)	10 (33.33)	94 (39.17)
3.	Roots and tubers	Daily	14 (23.33)	7 (11.67)	4 (06.67)	3 (10.00)	-	28 (11.67)
		More than thrice/week	27 (45.00)	42 (70.00)	49 (81.67)	20 (66.67)	18 (60.00)	156 (65.00)
		Once per week	19 (31.67)	10 (16.67)	7 (11.67)	7 (23.33)	12 (40.00)	55 (22.92)
		Never	-	1 (01.67)	-	-	-	1 (00.42)
4.	Other vegetables	Daily	41 (68.33)	37 (61.67)	44 (73.33)	7 (23.33)	21 (70.00)	150 (62.50)
		More than thrice/week	19 (31.67)	23 (38.33)	13 (21.67)	19 (63.33)	9 (30.00)	83 (34.58)
		Once per week	-	-	3 (05.00)	4 (13.33)	-	7 (02.92)
5.	Green leafy vegetables	Daily	1 (01.67)	2 (03.33)	-	-	-	3 (01.25)
		More than thrice/week	23 (38.33)	28 (46.67)	25 (41.67)	4 (13.33)	20 (66.67)	100 (41.67)
		Once per week	34 (56.67)	36 (43.33)	34 (56.67)	23 (76.67)	10 (33.33)	127 (52.92)
		Never	2 (03.33)	4 (06.67)	1 (01.67)	3 (10.00)	-	10 (04.17)

Table 18 continued

Sl. No.	Food items	Category	Percentage of sample groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
6.	Fruits	Daily	28 (46.67)	28 (46.67)	27 (45.00)	—	14 (46.67)	97 (40.42)
		More than thrice/week	20 (33.33)	28 (46.67)	29 (48.33)	9 (30.00)	11 (36.67)	97 (40.42)
		Once per week	12 (20.00)	4 (06.67)	4 (06.67)	20 (66.67)	5 (16.67)	45 (18.75)
		Once per month	—	—	—	1 (03.33)	—	1 (00.42)
7.	Milk and milk products	Daily	49 (81.67)	30 (60.00)	37 (61.67)	—	28 (93.33)	150 (62.50)
		More than thrice/week	9 (15.00)	22 (36.67)	23 (38.33)	17 (56.67)	2 (06.67)	73 (30.42)
		Once per week	2 (03.33)	2 (03.33)	—	13 (43.33)	—	17 (07.08)
8.	Meat	Daily	3 (05.00)	—	—	—	—	3 (01.25)
		More than thrice/week	—	—	2 (03.33)	—	—	2 (00.83)
		Once per week	9 (15.00)	15 (25.00)	11 (18.33)	—	4 (13.33)	30 (16.25)
		Once per month	36 (60.00)	34 (56.66)	38 (63.33)	24 (80.00)	25 (83.33)	157 (65.42)
		Never	12 (20.00)	11 (18.33)	9 (15.00)	6 (20.00)	1 (03.33)	39 (16.25)
9.	Fish	Daily	37 (61.67)	41 (68.33)	38 (63.33)	17 (56.67)	13 (43.33)	146 (60.83)
		More than thrice/week	18 (30.00)	14 (23.33)	21 (35.00)	13 (43.33)	15 (50.00)	81 (33.75)
		Once per week	2 (03.33)	4 (06.67)	—	—	1 (03.33)	7 (02.92)
		Never	3 (05.00)	1 (01.67)	1 (01.67)	—	1 (03.33)	6 (02.50)

Table 18 continued

Sl. No.	Food items	Category	Percentage of sample groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
10.	Egg	Daily	4 (06.67)	1 (01.67)	3 (05.00)	–	1 (03.33)	9 (03.75)
		More than thrice/week	22 (36.67)	20 (33.33)	20 (33.33)	3 (10.00)	14 (46.67)	79 (32.92)
		Once per week	31 (51.67)	35 (58.33)	35 (58.33)	23 (76.67)	14 (46.67)	138 (57.50)
		Once per month	–	–	–	4 (13.33)		4 (01.67)
		Never	5 (05.00)	4 (06.67)	2 (03.33)	–	1 (03.33)	10 (04.17)
11.	Fats and oils	Daily	50 (90.33)	60 (100.00)	60 (100.00)	20 (66.67)	30 (100.00)	229 (95.42)
		More than thrice/week	1 (01.67)	–	–	9 (30.00)	–	10 (04.17)
		Once per week	–	–	–	1 (03.33)	–	1 (00.42)
12.	Sugar and jaggery products	Daily	59 (98.33)	60 (100.00)	58 (96.67)	17 (56.67)	30 (100.00)	224 (93.33)
		More than thrice/week	1 (01.67)	–	1 (01.67)	13 (43.33)	–	15 (06.25)
		Once per week	–	–	1 (01.67)	–	–	1 (00.42)
13.	Bakery items	Daily	8 (13.33)	5 (05.00)	10 (16.67)	–	8 (26.67)	29 (12.08)
		More than thrice/week	18 (30.00)	19 (31.67)	14 (23.33)	5 (16.67)	15 (50.00)	71 (29.58)
		Once per week	29 (58.33)	33 (55.00)	32 (53.33)	23 (76.67)	7 (23.37)	124 (51.67)
		Once per month	2 (03.33)	4 (06.67)	3 (05.00)	2 (06.67)	–	11 (04.58)
		Never	3 (05.00)	1 (01.67)	1 (01.67)	–	–	5 (02.08)

Table 18 continued

Sl. No.	Food items	Category	Percentage of sample groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
14.	Beverages oils	Daily	42 (70.00)	46 (76.67)	44 (73.33)	17 (56.67)	2 (06.67)	151 (62.92)
		More than thrice/week	15 (25.00)	12 (20.00)	14 (23.33)	13 (43.33)	18 (60.00)	72 (30.00)
		Once per week	2 (03.33)	2 (03.33)	2 (03.33)	–	9 (30.00)	15 (06.25)
		Never	1 (01.67)	–	–	–	1 (03.33)	2 (00.83)

4.4 Profile of learning disabilities, intelligence and overall development assessment

4.4.1 Profile of LD assessment

LD assessment was done on the basis of observations of the subjects made by the parents and the investigators in certain skills and activities performed by the subjects. The skills included were writing skill of language and arithmetic skill. As per the scoring procedure, higher the score obtained, greater was the degree of LD.

The scores obtained were classified into four categories on the basis of mean score and the standard deviation, namely 'very low' ($\leq$ x), 'low' (x - SD) and 'high' (x + SD) and very high (> x + SD). Here since the scoring pattern was such that higher the score, higher the incidence of LD. The 'high'

category constitutes those having typical features of LD ℓow Score denotes Low LD. The groupwise distribution of the categorisation is shown in Table 19.
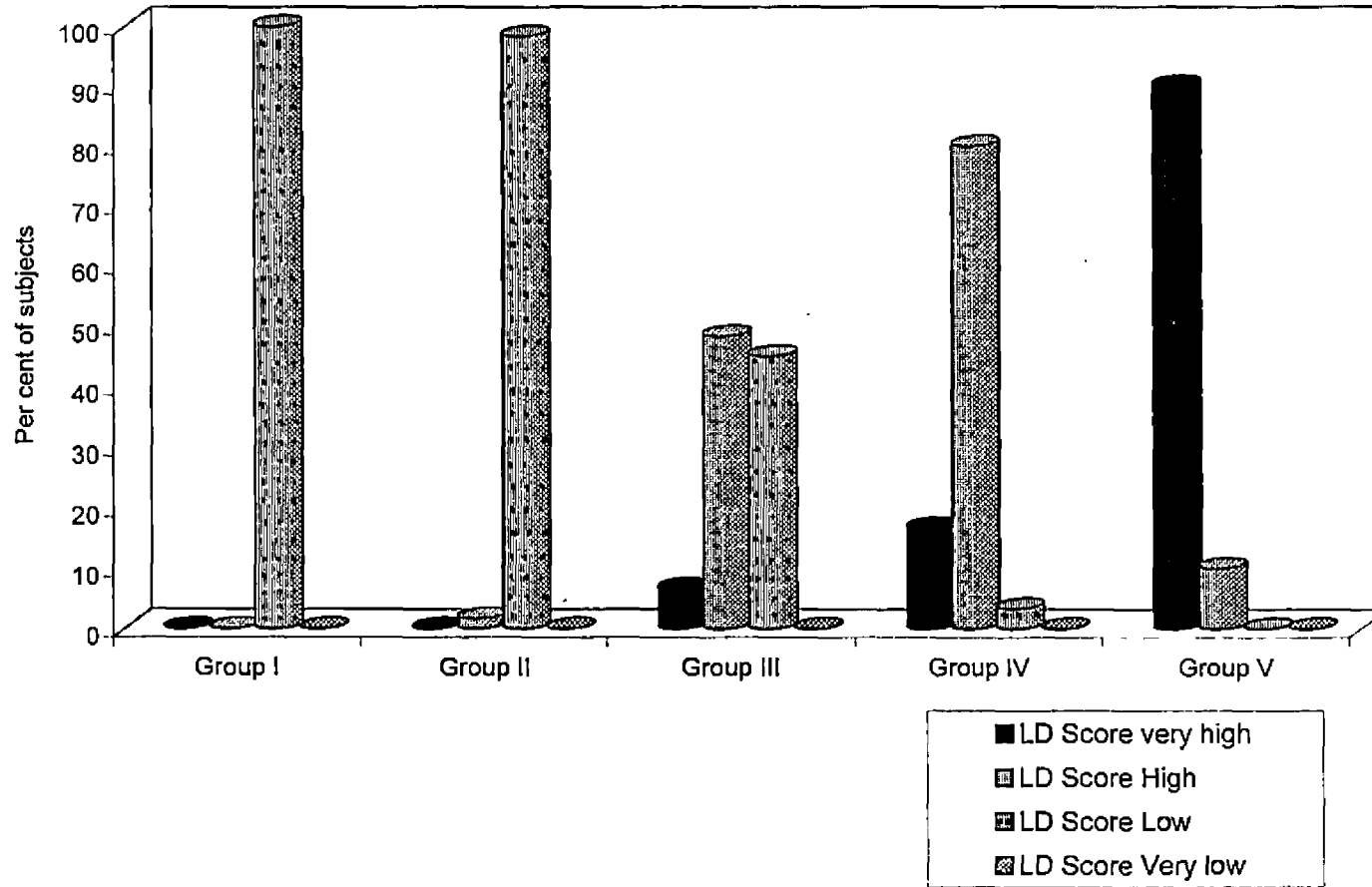
Accordingly the table revealed that out of the total sample studied about 147 (61.25 per cent) were in the low degree category, which was constituted by 60 (100.00 per cent) from Group I, 59 (98.33 per cent) from Group II and 27 (45.00 per cent) from Group III. And it was noted that no one in Group V came under this category ie, the very low category as was obvious. Majority in Group V ie, 27 out of 30 (90.00 per cent) showed very high degree of LD. So did the majority in Group III and IV, showed high degrees of LD ie about 29 out of 60 (48.33 per cent) and 24 out of 30 (80.00 per cent) respectively. Except for one subject in Group II, there were none from both Group II and I (Figure-6)

Table 19

Groupwise distribution of sample based on LD assessment score

Sl. No.	LD score category	Score range	Groups					Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1.	Low	119.2-143.8	60 (100.00)	59 (98.33)	27 (45.00)	1 (03.33)	–	147 (61.25)
2.	High	143.9-168.5	–	1 (01.67)	29 (48.33)	24 (80.00)	3 (10.00)	57 (23.75)
3.	Very high	> 168.6	–	–	4 (06.67)	5 (16.67)	27 (90.00)	36 (15.00)

Figure 6
Profile of LD score of sample groups

Figure 6 — Profile of LD score of sample groups. A three-dimensional bar chart plotting "Per cent of subjects" (y-axis, 0 to 100) against Group I, Group II, Group III, Group IV, and Group V (x-axis). Legend: LD Score very high, LD Score High, LD Score Low, LD Score Very low.

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4.4.2 Profile of intelligence

The results obtained by the 240 study subjects, for Raven's CPM test and Draw-a-man tests are presented in the following part (Table 20).

4.4.2.1 Raven's CPM test score

Based on the percentile rank obtained by the subjects for this test, they were classified into five categories, as per the test manual. They are; 'intellectually superior', 'intellectually above average', 'intellectually below average' and 'intellectually impaired'. Table 20 illustrates the groupwise distribution of the subjects based on this classification of their percentile rank. Accordingly, about 65 out of 240 subjects(27.08 per cent) were found to be intellectually impaired, of which 22 were in Group III (36.67 per cent), 28 in Group IV (93.33 per cent) and 15 in Group V (50.00 per cent). In Group I and II, there were none in this category. Group IV consisted mainly of intellectually impaired ie. 28 out of 30 (93.33 per cent) and 'intellectually below average' subjects ie 2 out of 30 (6.67 per cent) and none in the other categories. Only Group I had subjects in 'Intellectually superior' category ie 12 out of 60 (20.00 per cent) (Figure -7)

Figure 7

Profile of CPM score of sample groups

Legend:
□ Intellectually superior   ▧ Intellectually above average
□ Intellectually average   ▦ Intellectually below average
□ Intellectually impaired
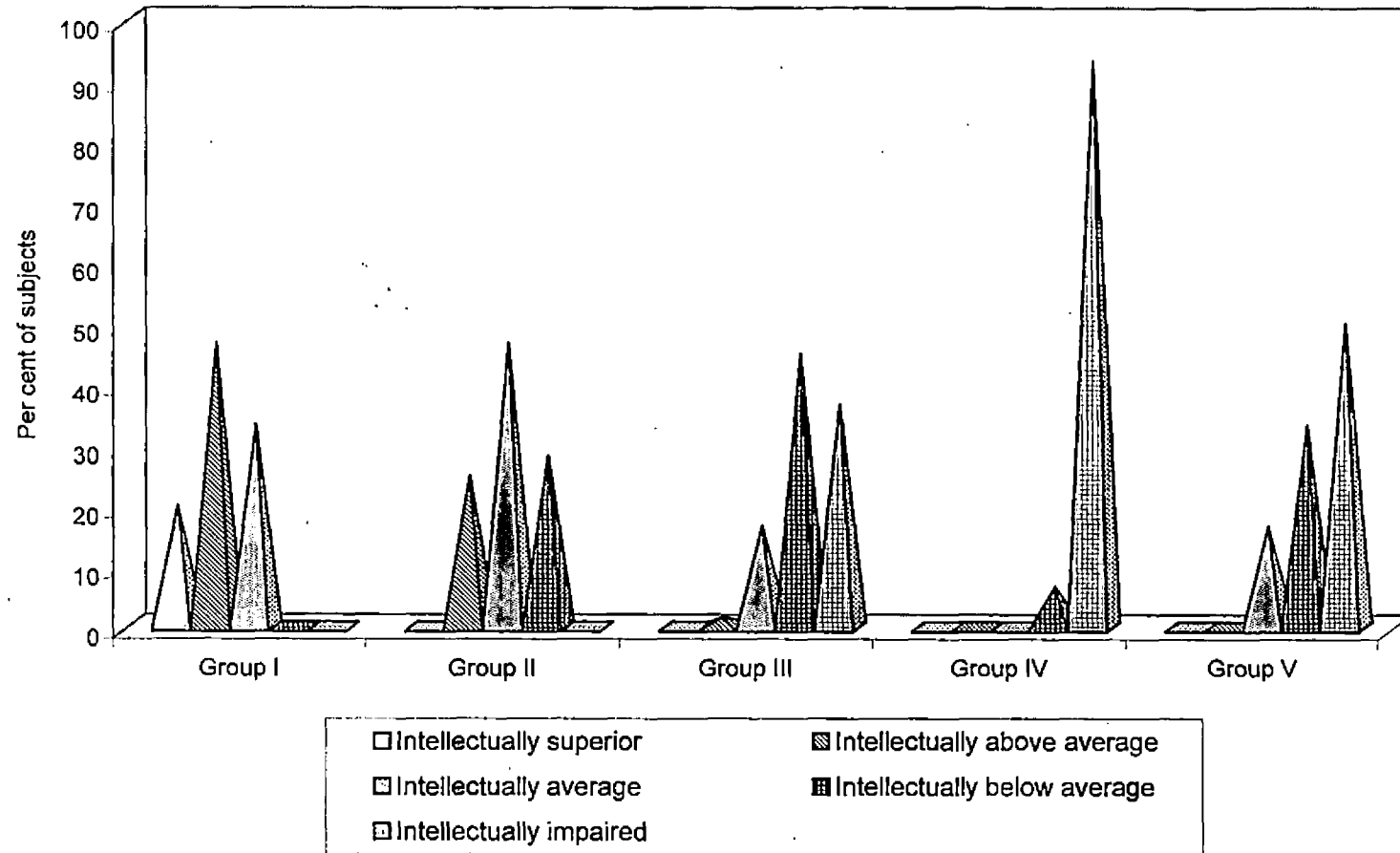
Table 20

Groupwise distribution of sample based on CPM Intelligence
test percentile

Sl. No. Intelligence gradation	Groups					Total
	G. I n=60	G. II n=60	G. III n=60	G.IV n=30	G.V n=30	n=240
1. Intellectualy superior	12 (20.00)	–	–	–	–	12 (05.00)
2. Intellectually above average	28 (46.67)	15 (25.00)	1 (01.67)	–	–	44 (18.33)
3. Intellectually average	20 (33.33)	28 (46.67)	10 (16.67)	–	5 (16.67)	63 (26.25)
4. Intellectually below average	–	17 (28.33)	27 (45.00)	2 (06.67)	10 (33.33)	56 (23.33)
5. Intellectually impaired	–	–	22 (36.67)	28 (93.33)	15 (50.00)	65 (27.08)

4.4.2.2 Profile of Draw-a-man's test score

Similar to the Raven's CPM test score, the percentile rank obtained by the subjects for Draw-a-man test was also classified into same five categories namely, 'intellectually superior', 'intellectually above average', 'intellectually average', 'intellectually below average' and 'intellectually impaired' as per the test manual. The categorisation of each group, on the basis of the score is detailed in Table 21.

The results of the test showed that 31 out of 240 (12.92 per cent) were in 'intellectually superior' category, which comprised of 19 in Group I (31.67 per cent), 10 in Group II

Figure 8

Profile of Draw-a-man score of sample groups

per cent of subjects

- ☐ Intellectually superior
- ☐ Intellectually average
- ☐ Intellectually impaired
- ☒ Intellectually above average
- ☷ Intellectually below average

emotional, social, intellectual, language, concept and participation in extra curricular activities. And on the basis of total mean score and the standard deviation, the overall development scores were classified into three categories namely 'normal' (x+SD), 'average' (x) and 'low' (x-SD). Accordingly, the scores were distributed groupwise to study the trend (Table 22).

Table 22 revealed that of the 210 subjects studied, about 113 (53.81 per cent) were found to have normal development score. Among the groups, all the 60 (100.00 per cent) in Group I belonged to 'normal' category, while in contrary only 1 out of 30 (3.33 per cent) in Group IV belonged to this category. In this Group majority ie. 19 out of 30 (63.33 per cent) were found to be in 'low' category, while in Group III 30 out of 60 (50.00 per cent) in 'average'. Meanwhile in Group II also 46 out of 60 (76.67 per cent) belonged to the normal category. (Figure-9)
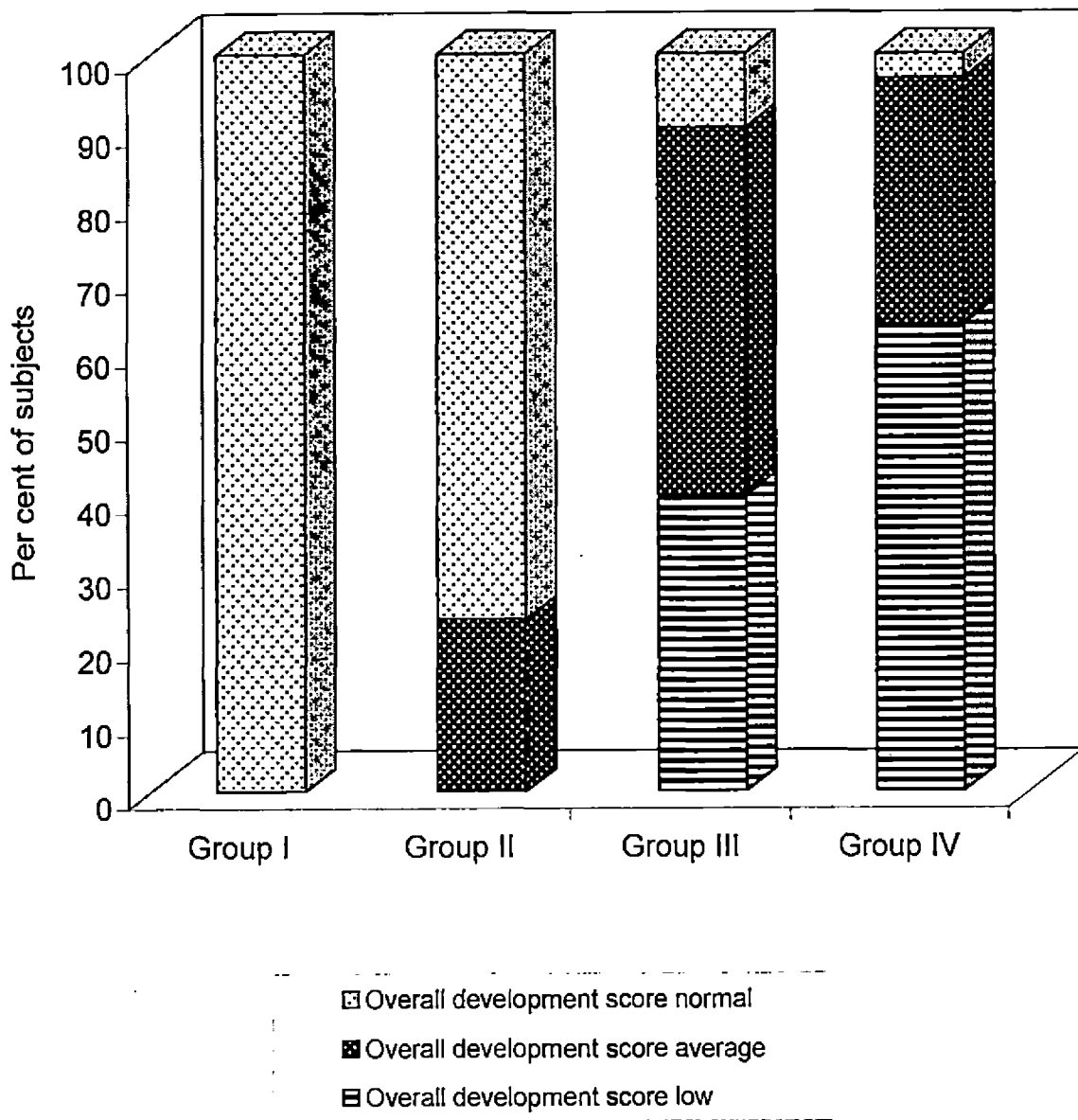
Table 22

Groupwise distribution of sample based on overall
development score

Sl. No.	Developmental level	Score range	Groups				Total
			G. I n=60	G. II n=60	G. III n=60	G.IV n=30	n=210
1.	Normal	> 132.8	60 (100.00)	46 (76.67)	6 (10.00)	1 (03.33)	113 (53.81)
2.	Average	132.9-112.9	–	14 (23.33)	30 (50.00)	10 (33.33)	54 (25.71)
3.	Low	< 112.9	–	–	24 (40.00)	19 (63.33)	43 (20.48)

Figure 9

Profile of overall development score of sample groups

Overall development score normal

Overall development score average

Overall development score low

4.5 Comparison of learning disabilities, intelligence, nutritional status and overall development among the study groups

The scores obtained by the subjects for LD tests, intelligence test, nutritional status and overall development assessments were subjected to ANOVA to see if any significant differences existed among the five study groups. The results thus obtained for each of the four variables are presented in this section.

The significant differences of the mean scores among the groups were ascertained by comparing it with the critical difference.

4.5.1 Comparison of LD

The LD assessments were constituted of parents' assessment score, investigator's assessment score, language writing score and arithmetic score. All these scores were summed up to get the LD assessment score. The scores for all the five study groups were computed and ANOVA was applied to the mean scores to study the differences among the groups regarding presence of LD. As per this test, higher the score, greater is the degree of LD.

The comparison along with the CD values are presented in Table 23. As per the table it could be noted that in all the five cases the results revealed were more or less similar. When

the groups were assessed by parents as well as investigator, for LD, it was found that Group V had the highest LD score while Group I the lowest. Similar results were also revealed in the case of the language writing skills and arithmetic skills, where the LD score was highest for Group V followed by Group IV.

But when the intergroup differences were studied it could be seen that the difference between all the group means were highly significant for the parents' evaluation of the LD, investigator's assessment and arithmetic ability. However for language ability, though there were intergroup differences, they were not significant as in other cases. Another observation made was that, though difference existed between Group III and IV, it was negligible throughout for parental assessment, investigator's assessment language and arithmetic skill. And for Group I and II also only negligible difference was seen for all the scores as well as the total score.

Finally when the mean of the total LD assessment score of each group was compared with the CD values, it revealed that except in the case of Group I and II, there was significant variation in the mean scores among all the other groups. Though the mean score of Group II is greater than that of Group I, the difference was not significant on comparison with the corresponding CD value. As in the rest, here too Group V had the highest mean score indicating highest incidence of LD, followed by Group IV and then Group III.

Table 23

Mean scores of the sample based on the LD assessment score

Sl. No.	Groups	Parent's assessment score	Investigator's assessment score	Language writing score	Arithmatic score	Total score
1.	I	26.85	10.67	64.53	22.12	124.22
2.	II	28.37	11.82	65.47	23.25	128.72
3.	III	31.92	13.05	75.22	27.55	148.53
4.	IV	32.93	14.33	78.43	29.63	156.73
5.	V	43.97	18.27	90.47	38.47	190.97
$F_{4,235}$		151.24**	137.00**	74.46**	217.74**	175.44**
CD Values						
I x II						
I x III		1.84	0.550	2.779	0.972	4.475
II x III						
I x IV						
II x IV						
III x IV		1.450	0.674	3.403	1.191	5.481
I x V						
II x V						
III x V						
IV x V		1.674	0.778	3.930	1.375	6.329

4.5.2 Comparison of intelligence test scores

The mean percentile obtained for the five study groups in Raven's CPM test and Draw-a-man test were also compared using ANOVA. The results thus obtained are presented in Table 24. As indicated in the table higher the score, greater is the intelligence.

The mean percentile rank for the Raven's CPM test when compared between groups on the basis of the CD values, it was

noticed that all the groups varied from each other significantly, except for group III and V. The highest mean percentile was that of Group I while Group IV had the lowest.

Likewise the mean percentile of Draw-a-man when compared among the groups indicated significant differences, except in the case of Group III and IV and between IV and V, where the differences were not significant. Similar to the case of Raven's CPM percentile, here also the highest mean percentile was that of Group I. But then Group V had the lowest mean here (Table 24).

Table 24

Mean values of sample based on intelligence scores

Sl.No.	Groups	CPM percentile mean	Draw-a-man percentile mean
1.	I	73.92	74.18
2.	II	49.67	65.62
3.	III	19.92	37.83
4.	IV	6.33	28.73
5.	V	17.67	24.07

$F_{4.235}$
CD values

		114.99 **	40.76 **
I x II			
I x III		6.408	8.505
II x III			
I x IV			
II x IV			
III x IV			
I x V		7.848	10.417
II x V			
III x V			
IV x V		9.062	12.028

4.5.3 Comparison of nutritional status

The subjects' current nutritional status was assessed using Gomez classification of weight for age. The mean of the percentage of weight for age (as per the standard classification), obtained for each group was then analysed using ANOVA, to find whether there was any significant variation among the groups. Table 25 represents the results obtained on these lines. The higher the score obtained, better is the nutritional status of the group.

FrOM the table, it could be seen that the mean percentage of Group I, II and III are not significantly different from each other when compared with the CD value. Similarly the mean percentage of Group IV did not differ from that of Group III significantly, but did with the rest of the groups, since it had the lowest mean. Meanwhile Group V which had the highest mean percentage differed significantly from all the other groups.

Table 25

Mean values of sample based on the nutritional status score

Sl.No.	Groups	Score mean
1.	I	84.60
2.	II	83.15
3.	III	82.06
4.	IV	76.90
5.	V	97.47

$F_{4,235}$		111.39**
CD values		
I x II		
I x III		4.508
II x IV		
I x IV		
II x IV		
III x IV		
I x V		5.521
II x V		
IV x V		
IV x V		6.375

4.5.4 Comparison of overall development assessment

Unlike the case of other assessment scores the overall development score of only the first four groups ie, Group I, II, III and IV were obtained. So the analysis of variance was applied only to the mean scores of these four groups for comparison (Table 26).

Table 26
Mean values of sample based on the overall development assessment score

Sl. No.	Groups	Physical develop-ment	Motor develop ment	Emotional develop-ment	Social develop-ment	Language develop-ment	Intellectual development	Concept develop-ment	Participation in extracarri-cular activities	General opinion	Grade score
1.	I	17.06	9.00	24.12	38.32	21.47	23.58	16.05	1.02	3.00	154.85
2.	II	16.07	8.38	22.77	35.08	19.52	18.82	14.72	0.93	2.08	139.72
3.	III	15.08	7.88	20.08	29.12	15.73	12.68	10.75	0.42	1.15	114.18
4.	IV	13.53	7.05	20.97	28.33	16.33	12.08	9.67	0.66	1.03	111.13

$F_{3.206}$ 81.99** 15.82** 26.96** 86.27** 130.46** 215.46** 190.77** 22.55** 680.05** 289.13**

CD values

	Physical	Motor	Emotional	Social	Language	Intellectual	Concept	Participation	General	Grade
I x II, I x III, II x III	0.430	0.400	0.936	1.346	0.614	0.931	0.583	0.194	0.091	3.143
I x IV, II x IV, III x IV	0.527	0.490	1.146	1.649	0.752	1.141	0.714	0.238	0.111	3.849

4.6 Intercorrelation of learning disabilities, intellegence, nutritional status and overall development and with some selected variables

Computation of correlation was essential for determining the relationship between the four dependent variables and those with other independent variables studied in this investigation. For this Pearson's Product Movement Correlation method was computed. The results thus obtained are presented as follows in Table 27.

Table 27

Intercorrelation of dependent variables and with selected independent variables

Sl. No. Variables	Correlation coefficient				
	LD assessment score	Intelligence Ravens CPM score	Test score Draw-a-man score	Nutritional status assessment score	Overall development assessment score
1. Socio-economic variables					
1.1 Age	0.137^{*}	0.283^{**}	0.548^{**}	0.196^{**}	0.116
1.2 Parents' educational status					
a. Fathers'	0.126^{*}	0.205^{**}	0.186^{**}	0.295^{**}	0.344^{**}
b. Mothers'	0.153^{*}	0.191^{**}	0.179^{**}	0.328^{**}	0.427^{**}
1.3 Number of siblings	0.182^{**}	-0.249^{**}	-0.206^{**}	-0.281^{**}	-0.266^{**}
1.4 Monthly income	0.111	0.044	0.047	0.218^{**}	0.259^{**}
2. Developmental variables					
2.1 Birth weight	-0.016	0.212^{**}	0.218^{**}	0.205^{**}	0.253^{**}
2.2 Breast feeding duration	-0.113	0.170^{**}	0.188^{**}	0.351^{**}	0.218^{**}

Table 27 continued

Sl. No. Variables	Correlation coefficient				
	LD assessment score	Intelligence Ravens CPM score	Test score Draw-a-man score	Nutritional status assessment score	Overall development assessment score
3. Health variables					
3.1 Nutritional status score	-0.599^{**}	0.306^{**}	0.215^{**}	–	0.432^{**}
3.2 Clinical symptoms	0.166^{*}	-0.345^{**}	-0.234^{**}	-0.254^{**}	-0.417^{**}
3.3 History of illness	0.141^{*}	-0.345^{**}	-0.234^{**}	-0.243^{**}	-0.257^{**}
3.4 Developmental problems	0.736^{**}	-0.534^{**}	-0.555^{**}	-0.199^{**}	-0.602^{**}
3.5 Behavioural problems	0.291^{**}	-0.207^{**}	-0.199^{**}	-0.238^{**}	-0.181^{**}
4. LD assessment score	–	0.521^{**}	0.562^{**}	-0.599^{**}	-0.753^{**}
5. Raven's CPM percentile	0.521^{**}	–	–	0.306^{**}	0.724^{**}
6. Draw-a-man percentile	0.562^{**}	–	–	0.215^{**}	0.454^{**}
7. Overall development assessment score	-0.753^{**}	0.724^{**}	0.454^{**}	0.432^{**}	–

** – Significant at 1% level
* – Significant at 5% level

4.6.1   Correlation of LD with other variables

LD score obtained from the tests for the five groups were correlated with other dependent variables as well as some of the selected independent variables. As shown in table 27, the LD score was found significantly correlated with all the other variables except with three viz., monthly income and developmental variables like birth weight and breast feeding duration. Among the variables seen correlated with LD score were number of siblings, developmental problems, behavioural problems and both the intelligence test scores. While those variables like age, parents' educational status, clinical symptoms and illness history were correlated with LD only at 5 per cent level. In the case of nutritional status and overall development the LD was found negatively correlated with both.

4.6.2   Correlation of intelligence with other variables

The two intelligence scores ie., Raven's CPM test and Draw-a-man test percentiles, when correlated with the selected variables brought into light the following results (Tables 27).

The table showed that both the intelligence test scores were significantly correlated with all the variables, except for monthly income. All the variables related to health aspect ie., clinical symptoms, history of illness, developmental problems and behavioural problems showed significant negative correlation with intelligence scores. The number of siblings category among the

social aspects was found negatively correlated to both intelligence scores, ie, as the number of siblings increased, decreased was the percentile scores for the tests.

4.6.3 Correlation of nutritional status with other variables

Nutritional status assessment score obtained for the subjects when correlated with certain selected variables and with other assessment scores, showed the following results (Table 27).

As per the table, it was observed that among the socio-economic variables, age, parents' educational status and monthly income had significant correlation with the nutritional status. Similarly number of siblings was also seen to be highly correlated but in the negative direction ie.,as the number of siblings increased, the nutritional status score decreased. Similarly significant but negative correlation was shown between the LD score and all the health variables studied ie, clinical symptoms, history of illness, developmental problems and behavioural problems.

The birth weight and the breast feeding duration among the developmental variables also showed highly significant correlation with LD.

4.6.4 Correlation of overall development with other variables

According to the Table 27, the overall development was seen significantly correlated with all the selected study

variables as well as other assessment scores, except for age. Parents educational status and monthly income was seen highly correlated with the overall development score, while number of siblings was found to be negatively correlated. Developmental variables like birth weight and breast feeding duration were also found to be positively correlated to the overall development score.

4.7 Association of learning disability assessment score with some selected variables

Chi square analysis was done in order to find the association if any of LD scores with some of the discrete variables. The results thus obtained are presented as follows in Table 28.

Table 28

Association of LD score with selected variables

Sl.No.	Variables	x^2 value
1.	Demogrpahic and social variables	
1.1	Sex	17.12**
1.2	Religion	15.11**
1.3	Caste	18.09*
1.4	Place of residence	4.56
1.5	Family size	0.25
1.6	Parents employment status	
a.	Father's	1.16
b.	Mother's	17.24**
1.7	Order of birth	0.11
2.	Developmental variables	
2.1	Term of delivery	5.41
2.2	Type of delivery	1.19
2.3	Bottle feeding duration	0.16
2.4	Immunisation history	0.28
3.	Dietary variables	
3.1	Food habit	0.03
3.2	Frequency of meals	0.01
3.3	Diet adequacy	17.51**

** - Significance at 1% level
* - Significance at 5% level

The variables under demographic and social variables profile when studied for its association with LD assessment score, showed that, religion and parents' type of employment were significant in their association both at five per cent level and one per cent level. While sex, place of residence, family size, caste and birth order had association with LD score only at five per cent level.

All the developmental variables and dietary variables showed no significant association with LD except in the case of liet adequacy which was seen highly associated with it.

DISCUSSION

DISCUSSION

The results presented in the previous chapter are discussed as follows:

5.1 Demographic and socio economic profile of the sample

Demographic and socio economic profile of the subjects were studied as several researchers have suggested that, the effects of nutrition can be understood only in terms of the family and social environment, kinds of economic and educational resources of the family of the children. These are also likely to influence the intelligence and academic performance of the children (Johnson *et al.*, 1989; Ricciuti, 1993). Accordingly, the analyses based on demographic and socio economic profile of the subjects, gives a vivid picture of the subjects studied. It could be observed that majority of the sample, particularly in the first three groups, were backward class of Hindus from low or lower middle income strata hailing from rural areas and with girls outnumbering the boys. Most of these children in these groups were first borns from small and nuclear type families, with one or two children having parents with high school education but unemployed mothers and labourer fathers. About half of the subjects lived in own thatched houses and enjoyed minimum facilities and conveniences in their houses. The pattern

of expenditure also was more or less same, with more on food, then on education and health care, with least on entertainment and savings.

However, Group IV and V differed from the other three groups in many aspects. Group IV consisting of malnourished children were mostly from families of lower socio economic strata hailing from coastal areas and majority were Christians belonging to scheduled castes. Parents of the majority had no regular jobs and had only primary school education, living in their own thatched houses and enjoying similar living conditions like the first three groups. Most of them were from nuclear families, the popular family type of the state, with one or two children. And interesting variation in this group was that most of them in this group were girls and either first or last borns in the family.

The low education and irregular income of the parents add to their low economic status. Further, it could be seen that. they spent a major portion of their income on food, health care and then only on education, though the amount spent from their meager income was very little. This finding is in tune with the findings of Sarvekshana (1992) and Food and Nutrition Board (1996). According to their studies, an average Indian spent major portion of his income on food followed by health care.

The poverty and poor socio economic status may be the reason for the malnutrition of the subjects in this group. This agrees with the findings of Levinson (1990) who had postulated that economic status is found to influence the health status of a child, since income and other related aspects directly influences the socio economic status of his or her family, its standard of living and the quality of life enjoyed by its members, which directly affects the purchasing power and indirectly influences the early feeding practices. Concurrent views were also pointed out by Pacey and Payne (1985), Agarwal *et al.* (1987), Beaton *et al.* (1990), Marjoribanks (1990), Mosyechuk (1992) and Reynold (1996).

Contradictory picture was observed in Group V consisting of LD children. Even though majority were from rural panchayats, they showed comparatively a better socio economic status, having parents with higher education and regular jobs and enjoying better income and living conditions. Most of them were also Hindus, but more from forward caste and less from schedule caste. Just as in other groups, here also majority were from small and nuclear type families, either first or last born as in Group IV. This disparity in demographic and socio-economic status may be due to the fact that, the sample of LD children were not randomly selected from the general population as in the other case. Here the group was identified from the only rehabilitational and training institute of children with LD and

it was found that, the institution was attended mostly by people from better income strata. Another interesting variation observed in this group was that, the boys dominated this group unlike the others. This is inaccordance with the findings of Marsh and Gearhart (1988) and Suchithra (1997).

5.2 Developmental, health and nutritional status of the sample

As indicated in the results, a probe into the developmental history, food consumption pattern, health and nutritional status and illness history of the sample was also made to get a better picture of the subjects.

It could be observed that Groups I and II consisting of subjects showing top and average rankers had more similarities with each other than other groups. Majority of them were full term babies, with normal birth weight and mostly breastfed for two to three years or more with less incidences of illness compared to other groups.

But Groups III and IV gave a different picture. These groups had more subjects born as premature and low birth weight babies, compared to other groups. According to Ghai (1996) birth weight is an indicator of foetal growth and development which reflected overall health and nutritional status of a child in his later years too. This could be contributing factor for the poor scholastic performances noted in Groups III and IV. This is in agreement with the findings of Singh (1991) and Sen *et al.* (1995)

WHO, in their studies had proved that low birth weight babies who survive infancy have permanent disabilities regarding physical and mental development. Also long term studies conducted by Child Development Centre, Trivandrum (1999) had suggested that low birth weight children continue to grow and develop both physically and mentally at lower rates compared to his or her normal weight counterpart. Saigal *et al* (2000) through their clinical experiments had opined that decreasing birth weight was associated with increased risks in having school difficulties.

Most of the subjects of these two groups were also breastfed but comparatively for a lesser period than the first two groups, but were given bottle feeding for longer duration than the other two groups. It has been a proven fact that breastfed babies have lower incidences of infections than artificially fed ie, bottle fed infants and their immune system is better equipped to counter any invading diseases. Swaminathan 1994), Gosh (1997), Elizabeth (1998) and Yaing and Shalee, (1999) had stated that children deprived of proper feeding practices showed frequent episodes of infections which increases the risk of malnutrition. Mahadevan (1992) had opined, that adequate breast feeding is the single most vital factor that facilitates the child growth. This could be one of the reasons for the high incidences of childhood ailments and diseases in these two groups. More developmental problems were also noticed in these groups.

However, the Group V of LD subjects had given an entirely different picture. Majority of these subjects (70.00 per cent) were born with normal weight, but had more premature babies (20.00 per cent) and only 67.00 per cent normal deliveries compared to 80 - 90 per cent normal births in other groups. The rest 33.00 per cent were born by caesarian or forceps or vaccum procedures. This shows a possibility of association between LD with type and term of birth. But contradictory to this observation, Gesell (1989) had said that there is a higher incidence of brain damage in premature children, but there is no higher incidence of prematurity in learning disabled children. At the same time, studies reported by Kawi and Pasamanik (1994) had reiterated that in some children, LD may be the precedent of changes in the brain resulting from complications during or immediately after birth. This indication of association between birth history and LD confirms the fact that assessment of birth and developmental history is also essential to identify children with LD.

Gosh (1989) had stated that about 51.00 per cent women in India exclusively breastfed their babies upto six months. And as noted in the other groups, this was true in the present sample too. But it was observed that the duration of breast feeding was less in Group V and more were bottle fed and for longer duration. The reason could be due to the problems associated with their disabilities. In the history of illness also this group had

higher incidences compared to other groups. Moreover problems like hyperthyroidism, hypotryroidism, meningitis and epilepsy were reported. Further about 16.66 per cent had delayed milestones and absence of birth cries. This again may be an indication of their disabilities and associated problems. Dykeman and Ackerman (1991) found in their studies that children with hyperthyroidism, episodes of meningitis and epilepsy also met with the criterion for LD.

A review of the psychological development was also as important, as mentioned by Skellern and Lennox (2000) inorder to assess, how well he or she has received the stimulus from the environment and adapted to it, thereby developing into a balanced personality. Accordingly in the present study as revealed in the previous chapter, Group V reportedly had some or other problems related to social, emotional, academic (especially in reading, writing and learning) and sleep habit. This similar phenomenon was reported by Pearl (1992) according to whom children with LD run a greater risk than their non disabled peers in having social and emotional problems other than those in learning. Studies comparing students with LD to their normal peers have shown that they are more anxious and withdrawn (Cullinan *et al.*, 1981) and are rated by adults as having behaviour problems (Deshler and Schumaker, 1993), less socially skilled (Stone, 1994) and have more problems interacting with teachers and parents (Bryan and Bryan, 1996).

Here thus more developmental and behavioural problems were observed in Group V, thereby agreeing with the earlier empirical evidence in the field. Thumb sucking, nail biting, bed wetting, were the common behavioural problems seen. In the case of Group V, this is certainly related to their disability, as has been reported by Orton (1987) and Owen *et al* (1991). And in the case of Group IV, it is the outcome of physiological and emotional stress they are undergoing as a result of poor nutritional status. As Kale (1992) had pointed out that behavioural problems seen among most of the children may be due to emotional, sociological and environmental stress.

The health and nutritional status of an individual has been proved as a good indicator of a person's intellectual performance and hence his learning abilities. Therefore a probe into these areas were also carried out. They were assessed through anthropometric measurements and clinical assessment. From the results, the following conclusions were made..

The anthropometric measurements taken for the assessment of health and nutritional status of the subjects revealed that average weight for age as well as average height for age of both boys and girls were mostly below the national and international standards. Though there were some exceptions in the case of height for age among the age group of five to six years in both boys and girls, mostly it was otherwise. Similar

deficits in body weight and height were reported among the rural and urban primary school children of lower and middle income groups as reported by NIN (1993). Vijayaraghavan *et al.* (1986) reported that well-to-do Indian children were found to be taller and heavier than the children belonging to the lower income group of corresponding ages. Similarly NNMB (1996) had reported that height for age and weight for age of children belonging to rural areas of Trivandrum are lower than the national standards. The reason for these children lagging behind in growth is obvious that they might be constantly exposed to long term nutritional deprivation, social and environmental strain as revealed in general studies (Madhavan *et al.* 1992; Ramachandran *et al.* 1996; Shah and Udani, 1998).

The nutritional status of the subjects when further evaluated by the classical procedure suggested by Gomez as per weight for age, it was found that, almost half of the total subjects studied had mild degrees of malnutrition. Another observation was that Group III was in par with Group IV in the prevalence of moderate degree of malnutrition. The lower incidence of malnutrition in Group V, could be due to the fact that, the subjects of this group mostly belonged to better socio economic backgrounds.

Clinical assessment has always been and remains important practical method for assessing nutritional status. In this study, the clinical assessment of the whole subjects

revealed that, anaemia was the most commonly seen deficiency symptom (ie about 30.83 per cent of total subjects) irrespective of group variations. Other than anaemia, bleeding gums, dyspigmentation of skin, angular stomatitis, night blindness and thyroid enlargement were the other deficiency symptoms seen. Mild to moderate degrees of malnutrition was seen in most of the subjects in all the groups. But in Groups III and IV, there were more number of subjects suffering from clinical symptoms of nutritional deficiencies too. The incidences of major killer diseases seen in children were practically nil. This may be due to the awareness among mothers in a cent per cent literate state about immunization

Gupta and Saxena (1997) had observed that anaemia, vitamin A and B complex deficiencies were common among primary school children. So did Prakash (1999) who reported that anaemia is the most widely prevalent deficiency symptom among the rural child population. But in contradiction NNMB (1996) had reported that manifestation of pure clinical deficiency signs in primary school children were much less ie, only 19.00 per cent had some or other clinical signs of deficiency disorder.

Unlike the other groups, Group V had least incidences of nutritional deficiencies, thereby establishing the fact that, they seems to be sound nutritionally owing to their better socio-economic and environmental background.

5.3 Profile on dietary habits and food consumption pattern

Robinson (1970) opined that dietary habit of an individual in general influences his or her nutritional status. And if the nutritional intake is inadequate it can cause the condition we commonly refer to as malnutrition. Singh and Dutt (1992) explained through their studies, how malnutrition affects the intellectual abilities, visual motor functioning and academic achievement of children. Hence the dietary and food consumption pattern of the subjects were studied in detail.

The food habits of the subjects when studied showed that majority in all the five study groups as being non-vegetarians. This finding was in line with that of Stephanie (1984) who had observed in South India, that only about 28.00 per cent of the total population were completely vegetarian.

As for the frequency of meals per day, on an average, Keralites are in the habit of taking three meals per day pattern, namely, breakfast, lunch and dinner, especially among the middle income population. But among the economically backward class this becomes two meals per day (Babu, 1994). Similar to this trend reported, in the present study also, majority of the subjects took three meals per day. But in the case of Group IV which had more percentage of economically backward subjects, about 10.00 per cent said that they took only two meals per day.

For the availability of all the nutrients to an individual it is necessary to consume a mixed diet consisting of all the five basic food groups (Antia, 1989). A diet inadequate in the basic foods can adversely affect the nutritional status of children (Robinson et al., 1986). On this basis, the dietary consumption of the subjects for three consecutive days were studied inorder to find the diet adequacy. As a result, half of those studied were noticed to be consuming inadequate diet. As expected in Groups III and IV majority consumed inadequate diet. This may be due to lack of income as well as lack of awareness regarding balanced diet.

On assessing frequency of use of various food items it was showed that majority in all the five groups used cereals on a daily basis which is considered as a staple food of Indian diet. Similar results were also reported in the studies by Shah et al. (1983), Preet and Bhavana (1988), Parvathi and Babitha (1989) and NNMB (1990).

Majority of the sample consumed, other vegetables, fruits, milk and milk products and fish daily. NNMB (1990) had in their survey report stated that second to cereals and millets, vegetables were consumed daily by about 11.09 per cent of the Indian rural population while green leafy vegetables constituted only 10.00 per cent of total vegetable intake. Here too green leafy vegetables found a place in the daily diet of only about

1.25 per cent of the total subjects while majority used it only once per week. When milk and its products stood third in consumption level of the rural people (as per NMMB report), here also it was as popular as other vegetables and consumed daily. Though as per the report of NNMB, protective foods like fruits, fish and meat are consumed in a very small proportion of families on any particular day, in this study majority took fruits and fish daily while meat was consumed only once per month by most of the subjects. Non-vegetarianism was seen popular among the study sample. Only 3.33 per cent included pulses in their daily diet.

Similar studies conducted among the children from 5 to 10 years of age in the rural area of Trivandrum by Begum (1990) had found that the diet of most of the children comprised mostly of cereals, roots and tubers and fleshy foods especially fish. While intake of milk and milk products and leafy vegetables were noted to be below 50.00 per cent of their requirement. Thus, majority of the subjects, diet consumed were found not balanced in terms of food groups.

The diet of children in Group IV coming from economically backward families and who rank lowest academically, were constituted mainly of cereals, roots and tubers and fish alone unlike the other groups. Poverty may be the main reason for the lack of variety and adequacy in their diet. But an interesting observation was that, inspite of the group variation in income status, most of the subjects were in the habit of

taking bakery or the confectionery items at least once per week, which reflects the growing popularity of "junk foods" among the new generation.

5.4 Profile on learning disabilities, intelligence, nutritional status and overall development

The profile of the five groups based on the four dependent variables, revealed that Group I and II consisting of top rankers and average rankers showed better intelligence and overall development scores as expected. Group V, comprising of clinically identified LD subjects had better nutritional status and overall development, but comparatively poor intelligence and very high degree of LD. Group IV was also high in LD and also poor in the other three factors viz., intelligence, nutritional status and overall development score. Group III comprising of low rankers also showed more or less similar results. All these suggest an association of LD with nutritional status, intelligence and over all development.

5.5 Comparison of learning disabilities, intelligence, nutritional status and overall development assessment scores of the five groups

Inorder to find whether the differences noted between the groups were significant enough, ANOVA was applied.

The results of the ANOVA done on LD indicates that the LD score was highest for Group V. Also as per the parent's and investigator's assessment, this group showed highest degree of LD, and were significantly different from all the other groups with respect to this score. It could be noted that the disability was directly proportional to academic achievement and inversely proportional to malnutrition, since the Group III and IV subjects, showed high incidences of LD. The difference in the total LD score of Group III and IV were significant with Group IV showing higher incidences. This must have been influenced by the fact that in Group IV all those studied had mild to moderate degrees of malnutrition. Similarly, though the total LD scores of Group V and IV are significantly different with Group V having the highest, there is definitely more incidence of LD in Group IV subjects compared to the first three groups.

Thus it could be assumed that the incidence of LD is certainly influenced to an extent by malnutrition. Empirical studies done in the child population of Kerala had pointed out that almost 10 to 15 per cent of school going population are affected by learning disabilities. So also about 9 to 10 per cent of a representative group of primary school children in the Trivandrum city showed subnormal scholastic performance (SCTIMST, 1997). It is also revealed that about 25.03 per cent of school children are mildly and 34.07 per cent are moderately malnourished in our country. Hence malnutrition could be the reason for the high incidence of LD in school children.

Group V varied significantly from Group IV in Draw-a-man test. As mentioned earlier the slight variation may be because of the aptitudinal differences shown by some of the subjects. Even with all the intergroup variation it could be concluded that the intelligence of the last three groups ie.,III, IV and V are remarkably lower than the other two groups. This shows that intelligence, malnutrition and learning disability are closely related.

ANOVA was also applied to the nutritional status score obtained by the five groups to study the difference among the groups. As a result no significant difference was noticed in the first three groups. Meanwhile, as expected Group IV differed significantly from all the other groups except from Group III. This suggests that poor nutritional status indeed is closely associated with failure in academic performances. But contradictory to this, the Group V ie.,subjects, identified as LD cases showed a better nutritional status than even the Group I subjects of top rankers. This could be expected, as the majority of the subjects in this group belonged to middle income as well as upper middle income group. About 6.67 per cent belonged to higher income also. Whereas in the other groups only less than half belonged to middle and upper middle income, while none belonged to high income category. And in the case of Group IV all belonged to low and lower middle income groups. This shows that, though higher incidence of LD was seen in malnourished

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When ANOVA was applied to the intelligence assessment score of the five groups, the following results were obtained.

As mentioned earlier, inorder to assure more accuracy and reliability in their intelligence assessment, the subjects were tested using two separate intelligence tests ie Raven's CPM test and Draw-a-man test. The results of ANOVA on these two test scores showed more or less similar trend. Group I consisting of top rankers scored the highest in both the tests. The scores descended according to their academic achievement and as expected the scores were very low among Groups IV and V. But when the results of the two tests were compared, though similar direction was shown, there was disparity in the scores between the other four groups. For CPM, the scores dropped considerably for the other groups, while for Draw-a-man test, the difference was not so great. For Draw-a-Man test Group V showed lowest intelligence unlike in CPM test, where Group IV had lowest score. This slight variation may be due to the aptitudinal variation shown by a few subjects. This points to the fact that, intelligence level can be low both in these groups.

When intergroup disparity was studied, significant difference was seen between Group III and IV in CPM test, but not so in Draw-a-man test. The very low score of the Group IV in CPM may be due to their poor nutritional status. Group III showed significant variation from Group V in CPM test score, whereas the

Group V varied significantly from Group IV in Draw-a-man test. As mentioned earlier the slight variation may be because of the aptitudinal differences shown by some of the subjects. Even with all the intergroup variation it could be concluded that the intelligence of the last three groups ie.,III, IV and V are remarkably lower than the other two groups. This shows that intelligence, malnutrition and learning disability are closely related.

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children as well as low achievers. But children with LD need not
be malnourished always. But since greater incidence of LD is
seen in Group III and IV subjects, it is to be inferred that,
poor socioeconomic and nutritional status does have some impact
on LD.

The growth and development of an individual starts from
the time he or she is conceived in the mother's womb and
continues throughout even after birth. And emperical studies
have proved the relationship of physical and mental development
with the intelligence, learning disabilities as well as
nutritional status.

Accordingly, the overall development assessed, were
also analysed through ANOVA to find the significance in the
difference between groups. Since, the score for Group V was not
obtained, only the first four groups were compared. Here also
the results obtained were as expected. When Group I obtained the
highest total score for overall development, Group IV got the
lowest. The differences in the total score of Group I, II and
III were significant while that between Group III and IV were
nonsignificant. Even in each area of development ie. physical,
motor, emotional, social, language, intellectual, conceptual, and
extra curricular activities too more or less similar trend was
noted. This again emphasises the impact of inadequate nutrition
or malnutrition on overall development.

Ultimately, the inference that could be drawn from the ANOVA done on the five groups pointed out that Group I consisting of top rankers, dominates in all aspects such as nutritional status, overall development and intelligence and also in the absence of LD. Group II consisting of average rankers showed more similarities to Group I. Meanwhile Group III and IV proved lowest in areas of nutritional status, overall development, intelligence and highest in incidences of LD. However, in Group V though the subjects were found to have poorer intelligence and overall development apart from high level of disabilities, nutritionally, they excelled the other four groups. But in contrast, as the Groups IV and III showed greater incidences of malnutrition and LD it could be inferred that malnutrition does have an indirect impact on LD.

5.6 Correlation of the dependent and independent variables
5.6.1 Learning disabilities

LD score was found to have a significant relationship with, most of the demographic and social variables such as age, parents educational status and number of siblings showing that to an extent social and demographic factors does have an influence on LD besides nutritional adequacy.

This agrees with the study made by Paul (1997) that LD may be because of the causes in the child or due to disturbances in the environment such as home and school. Patel *et al.* (1998)

had also pointed out the importance of socio economic and cultural factors along with proper nutrition on the intellectual performance and learning skills of children. Among the variables studied correlation with number of siblings in the family, developmental and behavioural problems and intelligence were found to have high significant positive correlation. But the relationship with overall development was in the negative direction but significant. So also negative significant correlation was seen between nutritional status and LD score which may be due to the influence of the heterogeneous group V belonging mostly to better income strata and hence better nutritional status. Except for the views expressed by physicians and clinical psychologists, not many direct research studies in this area are available. But the relationship of intelligence and malnutrition with socio economic factors have long been established. Researches done by Ashworth (1986), Agarwal *et al.* (1987), Marjoribanks (1989) and Mosyechuck (1992) supports this. The close relationship of LD with intelligence and nutritional status disclosed in the study suggests that these factors might have an indirect relationship with LD too.

The analyses on the various environmental factors as discussed earlier agrees to this. The groups consisting of poor academic achievers and malnourished children rated high on the LD assessment test. Moreover these groups of children were from socio-economically backward families. Contradictory to this the

clinically identified LD subjects of Group V were from a better socio-economic background and also of better nutritional status. At the same time more of developmental and behavioural problems were also seen in this group indicating that these variables are closely related with LD.

As expected the overall development score was significantly and negatively correlated to LD score ie more the LD score, less is the score for overall development of the subjects. Similarly in accordance with earlier studies, low birth weight and duration of breast feeding was seen negatively correlated with LD though the relationship was insignificant in this study. Sigman *et al.* (1992) and Bartel *et al.* (1998) had pointed out the relationship of breast feeding, malnutrition and intelligence.

5.6.2 Intelligence

The relationship of the two intelligence test scores, with various variables studied were similar and in the same direction too. This confirms that the relationship of intelligence scores with the other variables are reliable and valid. Further all the demographic social and developmental variables showed highly significant relation with the intelligence scores. This agrees with the studies of Johnson *et al.* (1987). Winick *et al.* (1989) and Ricciuti (1993). So also many studies done on the merits of breast feeding and the

problems of low birth weight proclaimed the unquestionable relationship with intellectual development. The negative significant relation found between intelligence and that with both developmental and behavioural problems, shows that the existence of these problems are suggestive to intellectual deficit.

Similarly, the positive significant correlation of intelligence test scores with overall development score agrees with the accepted notion that in a child the normal development in physical, motor, social, language, emotional and conceptual abilities, actually reflects his normal intellectual development too.

5.6.3 Nutritional Status

The nutritional status score were found to have positive significant correlation with all the socio-economic and demographic variables and a negative significant correlation with number of siblings, ie as the number of siblings increased, the nutritional status assessment decreased. These influence of social and economic variables on the nutritional status of a child is in agreement with the studies of Suter and Hunter (1980), Susan (1992) Sen *et al.* (1995) and NNMB (1996) who had studied that nutritional status of children is influenced by their socio-economic status. The negative and significant correlation found between nutritional status score and LD score

was, discussed earlier. Developmental variables such as birth weight and breast feeding had positive correlation with the nutritional status as has been supported by Ahammed *et al.* (1998) and Madhavan (1992) respectively. The variables associated with health, such as clinical symptoms, history of illness and developmental and behavioural problems were found to be negatively correlated with nutritional status as had been expected. It is an already established fact that as the nutritional status decreases, the clinical manifestation of various deficiencies increases and so does the incidence of illness. And presence of behavioural and development problems does accompany poor nutritional status. The positive significant correlation of nutritional status score with that of intelligence have also been discussed earlier.

5.6.4 Overall Development

The score of overall development assessment was found to be influenced by all the dependent and independent variables. Among the independent variables, except for age, all other socio economic variables were significantly correlated with overall development. Among the social variables, number of siblings was found negatively correlated with overall development as in the case of intelligence and nutritional status which showed that presence of siblings have a significant impact on all the four dependent variables studied. As mentioned earlier with nutritional status also overall development had a positive

significant correlation. And a highly significant negative correlation was seen between overall development and other health variables like, clinical symptoms, history of illness, developmental and behavioural problems as in the case of intelligence and nutritional status again indicating their inter relationship.

Based on the results of correlation in sum, the tenability of the null hypothesis formed under this is verified. Significant relationship is found with most of the variables studied, but not all variables. Hence the null hypothesis formulated in the context is partially substantiated.

5.7 Association of learning disability with selected variables

The Chi square analysis done to find out the association of certain discrete independent variables with the LD score revealed that sex of the subjects showed a highly significant association with LD score. This association was also evident in the profile of the sample based on sex presented in Chapter-4. This finding is in line with the findings of Marsh and Gearhart (1988) and Suchithra (1997).

Similarly religion and caste also showed highly significant association with LD score. But due to the heterogenesity and small size of the sample in this group, as well as the socio cultural background from where the sample was drawn

(ie from IRCCCD) no generalisation could be made in this respect without further investigation.

A significant association was disclosed between mother's employment status and LD. But no detailed analysis of the type of parental employment could be done in the present study. But, the results obtained, calls for further study in this direction.

Diet adequacy is yet another variable that revealed significant association with LD. When the diet adequacy profile of the five study groups were assessed it was found that the diets of majority in Group III and IV were inadequate and these two groups had majority of the subjects showing high LD scores too.

The studies made by Colgan and Colgan (1994) and Strody (1997) can be quoted here since, their attempts to find an association between nutrition and LD has yielded similar results. This again calls for further indepth study. Meanwhile no significant associations were noted between LD score and the rest of the discrete variables studied.

In short, the null hypothesis that, no significant association exists between LD and all the discrete variables studied was found to be partially rejected in the present study.

SUMMARY

SUMMARY

The increasing rate of school dropouts, juvenile deliquents and scholastic backwardness, is a grave concern of the day. Researches have shown that 10-15 per cent of children are globally presumed to be affected by learning disabilities. The very little researches done in our country and in Kerala particularly indicates, the prevalence of learning disabilities on par with that in the west, ie, one out of every ten children suffer from this disability. Yet India, including literate Kerala ignores this problem. Of recently attempts are being made to propel more researches in this field.

Not many scientific work has been done in this area. However the association of intellectual abilities and scholastic performance, with nutrition and socio economic factors have long been established. But whether such factors have an impact on learning disabilities, is yet to be probed into.

Taking into consideration, these facts, the present study was undertaken. Accordingly, the main objective of this study was to estimate the relative effect of malnutrition on learning disabilities of children between five and ten years.

A total of 240 subjects were selected into five groups ie Group I consisting of top rankers (60), Group II consisting of average rankers (60), Group III of low rankers (60), Group IV of

malnourished subjects (30) and finally Group V of identified
learning disabled subjects (30). The first three groups were
selected from the first to the fourth standards of three schools,
the fourth group from a Primary Health Centre and the fifth group
from IRCCCD - an institute for training and rehabilitation of
learning disabled children, affiliated to the Neurology
Department of Sree Chithra Thirunal Institute of Medical Science
and Research.

The dependent variables, in the study included, the
assessment scores of LD, nutritional status, intelligence and
overall development. While the independent variables consisted
of those related to demographic, socio-economic, developmental,
health, nutritional and dietary aspects.

The salient findings of the study are:

i) The demographic and socio-economic status of the subjects
studied revealed a heterogenous group of rural population,
ranging from low to middle socio-economic background, with
random representation from all the religion viz, Hindu,
Christian and Muslim and predominantly from backward castes.

ii) The health and developmental history showed comparatively
high prevalence of low birth weight, premature babies to
lesser duration of breast feeding and with higher incidences
of illnesses, developmental and behavioural problems, among
the groups comprised of low rankers (Group III),

malnourished (Group IV) and learning disabled subjects (Group V).

iii) The food consumption pattern indicated that, majority were non-vegetarians with half of the sample consuming inadequate diet (51.00 per cent). Cereals constituted the bulk of the diet, followed by daily consumption of fish, milk and milk products, vegetables, oil, sugar. Leafy vegetables and meat were consumed only in a very small quantity and rarely too. This agrees with the dietary consumption pattern of rural Keralites. More inadequacy in nutritional status was shown by low rankers and malnourished subjects when compared to top and average rankers and LD subjects.

iv) With respect to the prevalence of LD, intelligence, malnutrition and overall development of the subjects, the high and average rankers showed better nutritional status, intelligence, overall development and low LD score, compared to low rankers, malnourished and LD subjects. But the clinically identified LD subjects had better nutritional status and overall development than others though they scored poorly in intelligence and high in LD.

v) Analysis of variance was done on the five groups to find their differences in LD score, intelligence, nutritional status and overall development. On this basis it was found that the LD score of all the groups except for Group I of

top rankers and Group II of average rankers did differ significantly from each other, with Group V of identified LD subjects showing obvious high incidence. Similarly difference was shown in the case of intelligence also, where Group I showed highest score while Group IV of malnourished subjects, the lowest. In the case of nutritional status and overall development, Group I and Group II showed insignificant differences from each other. The difference between Group III and IV was also not significant, but Group V of LD subjects showed a significant difference from all the other groups in nutritional status. Thus in all, the result suggested that Group I of top rankers showed better intelligence, overall development and low incidence of LD. While in the case of nutritional status Group V topped the others, since most of them were from a better demographic and socio-economic background. Also the variation regarding the major scores, was negligible between Group III and IV of low rankers and malnourished subjects.

vi) The results of correlation revealed inter relationship with most of the variables studied. The dependent variables such as LD, nutritional status, intelligence and overall development showed significant relationship with independent variables like, age (except with LD score), clinical symptoms, history of illness, problems of development and behaviour. In the case of LD score and overall development

score, the relationship was in the negative direction. Surprisingly, income did not show any relationship with LD and intelligence. Further, LD showed negative correlation with nutritional status or malnutrition.

vi) When association of LD score was studied with certain discrete independent variables, the demographic and social variables like, sex, religion, caste, mother's employment status showed significant association. While all the other developmental and dietary variables, except for diet adequacy showed insignificant association.

Implications of the study:

The following inferences were drawn from the results of the study.

i) Learning disability is highly prevalent among academically low rankers and those who are mal nourished. Incidentally mild degrees of LD and malnutrition was seen among the normal children, who ~~performed~~ top academically.

ii) Low level intelligence, poor overall development and poor health and nutritional status are the other problems associated with poor scholastic performance and malnutrition.

iii) It was observed that LD was not always associated with poor nutritional status, demographic and socio-economic and

developmental variables. But problems in the development, health and behaviour were common in all the subjects with LD irrespective of demographic, socio economic and nutritional status.

iv) Another observation is that environmental factors like age, sex, familial characteristics like parents' educational and employment status, number of siblings and diet adequacy influenced LD, scholastic performance and cognitive abilities of the subjects in this study.

v) Income as such was found to have no direct influence on LD and intelligence in the present study.

vi) LD was found to be comparatively more common among boys than in girls.

The results obtained suggests the intervening role of malnutrition, poor socio economic and demographic background on learning disabilities, intelligence and overall development. It also suggests that poor scholastic performances of children is not always due to stubborness or lazyness on the part of the child, as conceived by teachers and parents, but may be due to the presence of learning disabilities. This prompts for further research in this field to develop means which enable parents and teachers to identify those children and thereby train them in overcoming this disability.

REFERENCES

REFERENCES

Agarwal, D.K., Upadhyay. S.K., Tripathi, A.M. and Agarwal, K.N. 1987. Nutritional status, physical environment and mental function in school children. *Scientific Report; Nutrition Foundation of India*, New Delhi, p. 20-24

Ahammed. P., Khan, A.Z., Hasan, B. and Sinha, S.N. 1998. Morbidity pattern in relation to birth intervals and birth order in children. *Indian Journal of Pediatrics*. 49: 689-693

Antia, F.P. 1989. *Clinical Dietetics and Nutrition*. Oxford University Press, Bombay, p. 438-441

Ashworth, A. 1986. A catch up growth following severe malnutrition. *Nutrition Review* 5: 44

Babu. R.V. 1994. Socio economic and health factors influencing the growth of children in economically backward class in Kerala. *Journal of Social Welfare* 8: 46

Bartel, P.R., Burnett, L.S., Greisel, R.D., Freiman, I., Rosen, E.U. and Geefhusyen, J. 1998. The effect of Kwashiorkor on performance of tests of neuropsychological function. *Psychologia Agricana* 17 : 153-160

Beaton. G., Kelly, A. and Kevany, J. 1990. Appropriate uses of anthropometric indices in children - A report based on ACC/SCN workshop. *Nutrition policy discussion paper.* WHO, Geneva : 32

Beegum, J.A. 1990. Impact of ICDS on the nutritional status of preschool children. *MSc. (FS&N)* thesis, Kerala Agricultural University, Thrissur, p. 126-127

Benjamin. A.I. and Zachariah, P. 1993. Nutritional status and feeding practices in under three year old children in rural community in Ludhiana. Health and Population Perspective of Issues. *World Health Forum* 16: 3-21

Britten. N. 1995. Qualitative interview in medical research. *British Medical Journal* 11: 684-694

Brown. H.W. 1978. Some records of the thoughts and reasonings of children. *American Journal of Psychology* 42: 358-359

Bryan, T. and Bryan, J. 1996. *In students with Learning Disabilities - Exceptional children.* Singular Publishing Group Inc., San Diego, p. 41-50

Burd. L. 1993. Tourette syndrome and learning disabilities. *Journal of Learning Disabilities* 25: 598-604

Carlton, R.M., Ente, G., Blurni, L., Davis, W. and Ambrosino, S. 2000. Rational dosages of nutrients have a prolonged effect on learning disabilities. Alternative therapy in health and medicine. *British Journal of Medicine* 6: 85-91

Cebak, V. and Najdanvie, R. 1990. Effects of undernutrition in early life on physical and mental development. *Archieve of Diseases in Children* 40: 532-534

Champakam, S., Srikanthia, S.G. and Gopalan, C. 1995. Kwashiorkor and mental development. *American Journal of Clinical Nutrition* 28: 844-850

Child Development Centre, 1999. A study of low birth weight babies and the risk related to it. *Project Report.* Medical College, Trivandrum, p. 1-47

Cole. K. 1987. *Learning disabilities - historical and conceptual issues.* Academic Press Inc., New York, p. 32-34

Colgan, M. and Colgan, L. 1994. Do nutrient supplements and dietary changes affect learning and emotional reactions of children with learning difficulties? A controlled series of 16 cases. *Nutrition and Health* 3: 69-77

Cravioto, J., Delicardie, E.R. and Birch, H.G. 1990. Nutrition, growth and neurointegrative development; An experimental and ecological study. *Pediatrics* 38:319-322

Crouse. S.L. 1999. What is Learning Disability? *American Journal of Clinical Nutrition* 52: 348-351

Crow, K.J. and Crow, F. A. 1985. Experimental design in intellectual measurement - Psychological Studies. *Journal of Genetics and Psychology* 15: 301-311

Cruickshank, W. and William, P. 1992. *Learning Disabilities - Historic and Conceptual issues.* Academic Press Inc., New York, p. 111-113

Cullinan, D., Epstein, M. and Lloyd, J. 1981. School behaviour problems of learning disabled and dyslexic children. *Journal of Learning Disabilities* 24: 598-604

Dahama, O.P. and Bhatnagar, O.P. 1988. *Education and communication for development.* Oxford and Publishing Co. Pvt. Ltd., New Delhi, p. 108-109

Darar, T.S., Singh, H.P., Sachdev, H.P., Monmohan, M., Mathus, S.K. and Bhargava, S. 1995. Acute dehydrating diarrhoea. *Indian Pediatrics* 22: 333-337

Das, J. and Jarman, R. 1991. *Cognitive integration; Alternative model for intelligences.* Lawrance Erlbrium Publisher, New Jersey, p. 86-88

Das, J.P. and Pivato. 1985. *Malnutrition and cognitive functioning.* International review of research in mental retardation. Academic Press, New York, p. 68-70

Department of Neurology, Sree Chithra Thirunal Institute for Medical Sciences and Technology, 1999. An Epidemiological survey of developmental language disorders and learning disabilities among school children in Kerala. *Interim report*. Sree Chithra Thirunal Institute of Medical Sciences and Technology, Trivandrum, p. 20-28

Deshler. D. and Schumaker, J. 1993. *In Children With Learning Disabilities - Exceptional Children*. Singular Publishing Group, Inc., San Diego, p. 80-83

Devadas, R.P., Rajalekshmi and Kaveri. 1980. Influence of family income and parents' educational level on nutritional status of pre school children. *The Indian Journal of Nutrition and Dietetics* 17: 337

Dykeman, R. and Ackerman, P. 1991. Attention deficit disorder and learning disability - Separate but often overlapping disorders. *Journal of Learning Disabilities* 24: 96-103

Elizabeth, K.E. 1998. *Nutrition and Child Development*. Paras Medical Publisher, Hyderabad, p. 109-112

Engelman, S. and Lovitt, J. 1987. *Exceptional children - Introduction to special education*. Allyn and Bacon. Inc., Boston, p. 248-249

Evans, H.K. and Divan, J.G. 1985. Dietary recall method - Comparison for hospitalized elderly subjects. *Journal of American Dietetics Association* 85: 202-205

Filskov, M. and Bull, J.D. 1982. Intelligence and learning disabilities - an overview. *American Journal of Occupational Therapy* 13: 129-135

Finucci, J. and Childs, B. 1983. *In Learning Disabilities - Exceptional Children, Introduction to special education.* Allyn and Bacon, Inc.,Boston, p. 48-52

Food and Nutrition Board Reports. 1996. Government of India, p. 27

Gaddes. W.H. 1995. *Educating child with learning disabilities.* Houghton Miffling Company, Boston, p. 152-161

Galler, J.R., Ramsey, F. and Solimano, G. 1984. Learning disabilities as a sequale to malnutrition. *Pediatric Research* : 309-313

Gessel, A. 1989. *The guidance of mental growth in infants and children.* Macmillan Publishers, New York, p. 48-50

Ghai, D.P. 1996. *Care of infants. Essentials of Pediatrics.* Jaypee International Publishers. Jabalpur, p. 36-39

Goldberg, H.K. and Schiffman, G.B. 1987. *Dyslexia - Problems of Reading Disabilities.* Grune and Stratton, New York, p. 232-238

Goodenough, F.L. 1976. A new approach to the measurement of intelligence of young children. *Journal of Genetics and Psychology* 58: 29

Gopaldas. T. and Seshadri, S. 1987. *Nutrition monitoring and assessment.* Oxford University Press, Bombay, p. 32-36

Gosh. B.N. 1989. Interrelations between social sciences and health sciences. Indian Association of Social Science Institutions 8: 75-78

Gosh. S. 1997. *Breast feeding - Nutrition and child care, A practical guide.* Jaypee Brother Medical Publishers, Bangalore, p. 146-147

Gupta. A.K. and Saxena, L.P. 1997. Case study of nutritional status of children from tribal areas in Mandla Block. *A report in the workshop on child nutrition in tribal areas,* Jabalpur, p. 49-58

Harrel, M.W., Parillon, C. and Frasklin. 1989. Nutritional problems associated with agricultural labourers. *Food Policy Report,* p. 5-8

Herman, K., Goldberg, J., Gilbert, B., Schiffman, G. and Stratton, N.Y. 1982. Dyslexia - Problems with reading disabilities. *Journal of Learning Disabilities* 22: 132

Hertzig, M.E., Birch, H.G., Richardson, S.A. and Tizard, J. 1989. Intellectual levels of school children severely malnourished during the first two years of life. *Peadiatrics* 19: 814-824

Hurlock, E.B. 1989. *Child growth and Development.* Tata McGraw Hill Publishing Company Ltd., p. 23-24

Illingworth. R.S. 1989. *The development of the infant and young children, normal and abnormal.* Language Book Society. Churchill Living Stone, p. 173-174

IRCCCD. 1999. Survey of children with Learning Disabilities in Kerala - A survey Report. Institute of Rehabilitation of Children with Cognitive and Comunications Disorders, Trivandrum, p. 1-28

James, Sushila, R. 1991. Application of Phatak Draw-a-man scale to the age groups of two-and half to six years and calculation of tentative norms. *M.Sc. Home Science dissertation,* M.S.University, Baroda, p. 76-77

Jelliffee, D.B. 1966. The Assessment of Nutritional Status of a community. *Monograph Series.* World Health Organisation, Geneva, p. 4-5

Johnson, S.A., Jovanoic, L. and Mar, K.R. 1989. The consequence of severe undernutrition in early childhood on subsequent cognitive development. *Nutrition Abstracts and Review* 51: 1927

Kale, S.V. 1992. *Child psychology and child guidance.* Himalaya Publishing House, New Delhi, p. 52-58

Kanwar, U.K., Sachdev, H.P., Manmohan, M. and Koranne, K.D. 1998. Paper on hill farm women in central Himalayas : International conference on appropriate agricultural technologies for farm women. *Abstracts*. ICAR. New Delhi,p. 35-38

Kawi, A.A. and Pasamanik, B 1994. Association of factors of pregnancy with development of reading disorders in childhood. *Journal of American Medical Association* 166: 1420

Khadilkar, P.M. 1986. Goodenough - Harris Draw-a-man test in school children in higher and lower socio-economic groups. *M.D. Pediatrics dissertation*. Shivaji University, Kolhapur, p. 211

Kirk, S.A. 1970. *Educating exceptional children.* Oxford and IBH publishing Co., New Delhi, p. 415

Klein, A.E., Habicht, J.P., Yarbrough, C., Sellers, G.S. and Bellers, M.J. 1994. Imperical findings with methodologic and mental development, nutrition, the nervous system and behaviour. *Pan American Health Organization Bulletin* 23: 251

Lerner, J. 1993. *Learning Disabilities - Theories, Diagnosis and Teaching Strategies.* Houghton Miffin Company, Boston, p. 206-210

Levinson. F.J. 1990. An economic analysis of malnutrition among children in rural India. *Food and Nutrition Bulletin* 3: 30-33

Lovely, R. 1996. Nutritional Status of women engaged in coir industry. *M.Sc. Science (FS&N) thesis,* Kerala Agricultural University, Thrissur, p. 112-113

Lovitt. H.B. 1987. *Observations on children with severe reading problems, learning disorders.* Special Child Publications, Seattle, p. 286-289

Marjoribanks, K. 1990. Another view of the relation of environment to mental abilities. *Journal of Educational Psychology* 66:460-463

Madhavan, S., Susheela, T.P. and Swaminathan, M.C. 1992. Association of growth, prevalence and nutritional deficiency signs among pre-school children. *Indian Journal of Medical Research* 28: 497-501

Mahadevan. 1992. *A risk concept. Health Education for Quality of life.* ELBS Publishers, Calcutta, p. 82-83

Marsh, G.E. and Gearhart, B.R. 1988. *Diagnosis and Management of Learning Disabilities - An inter disciplinary lifespan approach.* Singular Publishing Group. Inc., California, p. 180-191

Mc Gregor, M.S. 1987. The relationship between developmental level and different types of malnutrition in children. *Clinical Nutrition* 36: 319-320

Molloy. G.. Das. J. and Pierce, C. 1990. Some development trends in child's intellectual processing. *Psychological Reports* 66: 443-448

Monckeberg, F. 1991. Malnutrition and mental capacity. Nutrition the nervous system and behaviour. *Pan American Organisation Bulletin* 25: 48-53

Morrison, G. and Hark, L. 1996. Strategies to end micronutrient malnutrition. *Journal of Nutrition and Disease* 30:95-98

Mosyechuk, H. 1992. Differential home environment and mental ability patterns. *Doctoral thesis,* University of Alberta, p. 166-180

National Advisory Committee on Handicapped Children. 1985. *Learning disabilities - Historical and conceptual issues.* Academic Press, Inc., New York, p. 48-49

National Institutes of Health, 2000. Learning disabled children. *World Health Congresses Paper.* Geneva 8: 48

NCHS, 1990. National Centre for Health Statistics. NCHS Growth curves for children, birth to 18 years. DHEW Publication, New York 78:1650

NJCLD, 1987. Learning disabilities - Issues on definition. *Journal of Learning Disabilities* 10: 107-108

Nelson, M. 1993. Nutrition guidelines. *British Journal of Nutrition* 69: 935-940

Newman, L.G. 1992. Various dimensions of intellectual capacity - a clinical study in rats. *Journal of Personality and Clinical Studies* 11: 23-25

NIN. 1993. Evaluation of mothers of malnourished and normal children. *Nutrition News* 29: 16-19

NNMB. 1990. *Annual Report.* National Institute of Nutrition, Hyderabad, p.14

NNMB. 1996. *Annual Report.* National Institute of Nutrition, Hyderabad, p.23-2

Norman, J. and Munn. N.L. 1984. Learning in children. *Manual of Child Psychology.* Wiley Publishers, New York : 374-458

Orton, S.T. 1987. *Reading, writing and speech problems in children.* W.W.Norton and Co., New York, p. 6

Owen, F.W., Adams. P.A., Forrest, T., Stolz, L.M. and Fisher, S. 1991. *In Learning Disabilities - Introduction to special education.* Allyn and Bacon Inc., Boston, p. 322

Pacey and Payne, P. 1985. *Agricultural development and nutrition.* Published by FAO, UN and UNICEF. Hutchinson and Co. Ltd., London, p. 88

Parvathy, Eswaran. P. and Babitha. 1989. Nutritive value of selected 15 unconventional plant foods consumed in Meghalaya. *Indian Journal of Nutrition and Dietetics* 7: 62

Patel, M.A. 1998. Cognitive function in school children from low socio economic strata - A comprehensive study. *Medical Journal* 11: 684-694

Paul, B. 1997. *Diagnosing dyslexia - Needs of comprehensive assessment.* Child Care Centre, Kochi, p. 61-79

Pearl, R. 1992. *Children with learning disabilities - Introduction to special education.* Allyn and Bacon, Inc., Boston, p. 286

Pennington, B. and Smith, S. 1993. *Cited in children with learning disabilities - Educating exceptional children.* Houghton Mifflin Company, Boston, p. 291-299

Phatak, P. 1987. Application of revision and extension of Draw-a-man scale for Indian children. *Psychological studies* 29: 34-36

Phathak, P. 1987. *Draw-a-man Test for Indian Children.* Pramila Phatak Publishing Co., Pune, p. 40-45

Pollitt, E. and Thomson, C. 1996. Biological and social correlations of stature among children in the slums of Lima. American Journal of Orthophysiology 39: 735-740

Prakash, V. 1999. Malnutrition - micronutrient - why should India contribute to suffer malnutrition either macro or micronutrients. *Indian Journal of Nutrition and Dietetics* 36: 158-159

Preet, Kaur and Bhavana, S. 1988. Dietary pattern and nutritional status of spinning mill workers. *Indian Journal of Nutrition and Dietetics* 25: 315-319

Ramachandran. K.V., Deshpande, V.A., Apte, S.V. and Shukla, M.A. 1996. A study of nutritional status of school children in Bombay city. *Proceedings of Nutrition Society of India*. National Institute of Nutrition, Hyderabad, p. 51-83

Rao, K.U. 1994. The use of socio economic and mortality data to assess nutritional status. *American Journal of Nutrition and Dietetics* 5: 17-21

Rao. K.V. 1996. An evaluation of the relationship between nutritional status and anthropometric measurements. *American Journal of Clinical Nutrition* 23: 83-93

Rao, M. 1993. A follow up study of the influence of early malnutrition on subsequent development. *Nutrition and Behaviour* 13: 211-222

Rao. U.V. 1994. Malnutrition, environment and health. *Nutrition News* 31: 12

Rao and Vijayaraghavan. 1986. Protein energy malnutrition in South India. *Bulletin of World Health Organization* 20: 603-605

Raven, J., Raven, J.C. and Court, J.H. 1982. *Raven manual - Coloured Progressive Matrices*. Oxford Psychologists Press Ltd., Oxford, p. 66-80

Reynold. M. 1996. The role of nutrition in economic development. *Nutrition Reviews* 54: 566-571

Ricciuti. N.H. 1993. Interaction of adverse environmental and nutritional influence on mental development. The *Baroda Journal of Nutrition* 20: 237

Rizzo, T.A., Metzger, B.E. and Douley, S.L. 1997. Endocrinological disorders and intelligence - insights from the study of children with glandular imbalance. *Child Development* 68: 26-28

Robinson, C.H. 1970. *Normal and therapeutic nutrition*. Mac Millan Publishing Co., New York, p. 18-20

Robinson, C.H., Lawler, M.R., Chamoweth, W.L. and Garwick, A.E. 1986. Anaemia and iron deficiency - Normal and therapeutic nutrition. *The British Medical Bulletin* 37: 25-30

Rovet. J. 1996. *Students with Learning Disabilities - Integrating Research and Teaching*. Singular Publishing Group. Inc., San Diego, p. 42-43

Sadasivan, S., Kasthuri, R. and Subramanian, S. 1980. Nutritional survey in a village of Kerala. *The Indian Journal of Nutrition and Dietetics* 6: 243-245

Saigal, S., Hoult, L.A., Streiner, D.L., Stoskopf, B.L. and Rosenbaum. P.L. 2000. *Journal of Pediatrics* 105:325-331

Saito, K., Jekel, J.F. and Korzenik, J.R. 1986. Intellectual discripancy among opposite sexes : Intellectual subnormality - a sequeal to environmental detriments. *Pediatric Research* 18: 113-117

Santos, K. 1994. *Students with Learning Disabilities - Integrating Research and Teaching.* Singular Publishing Group Inc., San Diego, p. 45

Sarvekshana. 1992. National sample survey organisation. Department of Statistics. Ministry of Planning. Government of India 4: 16-17

Schunk, D.H. 1998. A review into the biological changes of brain in children with learning disabilities. *Journal of Learning Disabilities* 17: 533-535

SCTIMST. 1997. Dyslexia in ten per cent school children. *The Hindu daily* 125: 4

Sen, P., Mishra, C.P. and Gupta, V.M. 1995. An epidemological study of risk factors in pre school children of normal areas of Jampur district. *Indian Journal of Public Health.* 34: 58-63

Shah, C.H., Sawant, S.D. and Sanghavi, B.J. 1983. *Nutrition gap and economic analysis.* Himalaya Publishing House, New Delhi, p. 101-108

Shah, P.M. and Udani, P.M. 1998. Medical examination of rural school children. *Indian Pediatrics* 5: 343-361

Sigman, M., Newman, C., Jansen, A.A. and Bwibo, N. 1992. *Cognitive abilities of children in relation to nutrition family characteristics and education.* Child development. UCLA Publishers, London, p. 52-60

Singh, M. 1991. Strategies to improve the health of mother and children in India : Health and non-healthapproaches. *Regional Health Forum* 1: 37-39

Singh. M.P. 1993. Impact of environmental factors and nutrition on perceptual abilities and arithmetic achievement. *Journal of Psychology* 20: 130-131

Singh, M.P. and Dutt, K. 1992. Effect of malnutrition on cognitive abilities of rural primary school going children. *Indian Pediatrics* 3: 155-159

Singh. M.V., Anand, N.K., Dhingra, D.C. and Gupta, S. 1996. Intelligence in relation to degree of malnutrition. *Indian Journal of Clinical Psychology* 31: 117-120

Sinistarra, L. and Mckay, A. 1988. Improving cognitive ability in chronically deprived children. *British Journal of Medicine* 40: 1210-1213

Skellern. C. and Lennox, N. 2000. New insights into behavioural problems in children with dyslexia. *Journal of Learning disabilities* 29: 41-45

Stanovich, K., Cunningham, A. and Freeman, D. 1991. Intelligence, cognitive skills and early reading progress. *Reading Research Quarterly* 19: 278-303

Stephanie. P.R. 1984. Observations on dietary practices in India. *Nutrition Planning* 7: 2321-2322

Stock. C. 1979. The not quite child. *Journal of learning disabilities* 2: 51-52

Stock. M.B. and Smythe, R.M. 1985. Does malnutrition during infancy inhibit brain growth and subsequent intellectual development. *Archive of diseases in children* 38: 546-552

Stone. W. 1994. *Exceptional children with learning disabilities.* Singular Publishing Group, Inc., San Diego, p. 128-130

Strody. B.J. 1997. Benefit of docosahexaenoic acid supplements to dark adaptation in dyslexia. *Lancet* 32:385

Suchithra, N. 1997. Understanding children with Learning Disabilities. *The Week* 18: 17

Suja, P.T. 1989. Effect of birth order and spacing on the nutritional status of mother and child. *M.Sc. (FS&N) thesis*, Kerala Agricultural University, Thrissur, p. 39

Susan, K.J. 1992. Impact of banana based supplementary food on the nutritional status of infants. *M.Sc. (FS&N) thesis*, Kerala Agricultural University, Thrissur, p. 87

Suter. N. and Hunter. C. 1980. Influence on nutritional status - Overview of nutritional concerns. Nutrition principles and application of health. *American Journal of Nutrition* 32: 302-306

Swaminathan, M. 1994. Continum of maternity and child care support services. *Paper presented at the IAWS Conference.* Mysore,p.108-111

Swaminathan. M. 1998. *Malnutrition and infection. Essentials of nutrition.* Bappco publishing company, Bangalore, p. 218-221

Thorndike. L. 1989. *Measurement and Evaluation of Psychology and Education.* John Wiley and Jom Inc.,New York, p. 172

Upadhyay, S.K., Agarwal, D.K. and Agarwal, K.N. 1989. Influence of malnutrition on intelligence development. *Indian Journal of Medical Research* 90: 430-441

Vagh, L. and Anutai. P.L. 1992. Intelligence in physically handicapped children. *American Journal of Medicine* 102: 149-151

Vazir, S.. Sathyanarayanan, K., Narasingarao, B.S. and Ramalingaswamy, P. 1992. Undernutrition and Mental development. *ICMR Bulletin* 22: 69-74

Vijayaraghavan. K.. Darshan Singh, Swaminathan, M.C. 1986. Heights and weights of well-to-do Indian Children. *Indian Journal of Medical Research* 59: 648-654

Walsh. F.B. and Lidenberg. 1990. Hypoxia in children. Bull Johns Hopkins Manual 108: 100-114

Warren. N. 1989. Malnutrition and mental development. *Archieve of Diseases in Children* 80: 324

Weschler. D. 1981. *The measurement of adult intelligence.* William and Wilkins Publications, Baltimore, p. 258

Westman. W. and Golden, L. 1990. Subtypes of students with learning disabilities as derived from cognitive, academic, behavioural and self concept measures. *Learning Disability Quarterly* 13: 183 - 190

Winick. M., Meyer, K.K. and Harris, R.C. 1989. Malnutrition and environmental enrichment by early adoption. *Science* 190: 1173-1175

Winick, M. and Rosso, P. 1988. *Malnutrition and central nervous system development.* Wiley Publications, New York, p. 148-156

Yaing, D. and Shalee, S. 1999. Infant feeding practices on behaviour and food preference. *The Indian Journal of Nutrition and Dietetics* 36: 198-203

Ysseldyke. J. and Algozzine. B. 2000. *Who are students with learning disabilities? - Learning about learning disabled.* Academic Press, Inc., New York, p. 246

APPENDICES

APPENDIX - I
Kerala Agricultural University
Vellayani

Interview schedule to elicit information on Demographic
and Socioeconomic Details

I. Demographic Details   Code No.| ____ |

  1. Name of the child   :

  2. Age (in years)   :

  3. Sex   : M/F

  4. Religion   : Hindu/Christian/Muslim

  5. Caste   :

  6. Place of residence   : Panchayat/Municipality/
                                  Corporation

II. Socio Economic Details:

  1. Parents' educational status:

  1.1 Father   :

  1.2 Mother   :

  2. Parents' employment stauts :

  2.1 Father   :

  2.2 Mother   :

  3. Familiar details

  3.1 Family type   : Joint/Nuclear/Extended

  3.2 Family size   : Small/Medium/Large

  3.3 Number of siblings   :

  3.4 Order of birth   : First/Middle/Last/Others

4. Economic Details   :

4.1 Monthly income   :

4.2 Monthly expenditure pattern of the child's family

Sl. No.	Items	Expenditure range/month			
		Below 100/-	Between 100/- and 500/-	Between 500/- and 1000/-	Above 100/-
1.	Food				
2.	Clothing				
3.	Housing				
4.	Travelling				
5.	Education				
6.	Entertainment				
7.	Health Care				
8.	Miscellaneous				
9.	Savings				

4.3 Living conditions

4.3.1 Type of house   : Own thatched/Own tiled / Own concrete / Rented thatched/ Rented tiled/Rented concrete

4.3.2 Necessities available : Water supply / Electricity / Latrine facilities / None

4.3.3 Conveniences available : Radio/TV/Newspaper/ Refrigerator/Gas stove/None

APPENDIX - II
Kerala Agricultural University
Vellayani

Interview schedule to elicit information on Developmental details

Code No. |_____|

1.   Name of the child   :

I.   Physical Development Details   :

    1. Birth weight (kg)   :

    2. Term of birth   : Full term/Premature

    3. Type of delivery   : Normal / Caesarian/ Vaccum/
                                            Forceps

    4. Feeding history

    4.1 Breast feeding duration   :
          (in months)

    4.2 Bottle feeding duration   :
          (in months)

    5. Immunisation history

Sl. No.	Vaccines	Ist Dose	IInd Dose	IIIrd Dose	Booster Dose
1.	BCG				
2.	Triple antigen				
3.	Polio Vaccine				
4.	MMR				
5.	Hepatitis B				
6.	Others				

6. Illness History

Sl.No.	Illness	Yes	No	Specifications
1.	Childhood illness			
1.1	Measles			
1.2	Mumps			
1.3	Diarrhoea			
1.4	Dysentry			
1.5	Chickenpox			
1.6	Worm infestations			
1.7	Serious illness			
2.	Accidents			
3.	Operations			

II. Psychological Development Details:

1. Developmental problems

Sl.No.	Developmental Problems	Yes	No
1.	Emotional		
2.	Social		
3.	Sleep habits		
4.	Academic		
4.1	Reading		
4.2	Writing		
4.3	Learning		

APPENDIX - III

Schedule for Assessing Anthropometric measurements and Clinical Symptoms

Code No. |￣￣|

1. Name of the child:

2. Age

3. Anthropometric measurements:

    3.1 Height (cm)   -

    3.2 Weight (kg)   -

4. Clinical symptoms

4.1 Hair - Sparse

        Discoloured

        Easily Plucked

4.2 Moonface

4.3 Parotid enlargement

4.4 Oedema

4.5 Pellagra

4.6 Pigmentation of knuckles/fingers/toes

4.7 Crazy pavement dermatitis

4.8 Phrynoderma

4.9 Spongy bleeding gum

4.10 Emaciation

4.11 Maramus

4.12 Conjunctival xerosis

4.13 Bitot's spot

4.14 Corneal xerosis/Keratomalacia

4.15 Night blindness

4.16 Photophobia

4.17 Angular stomatitis

4.18 Cheilosis

4.19 Epiphyseal enlargement

4.20 Mottled enamel

4.21 Enlargement of thyroid

4.22 Anaemia

4.23 Dental caries

4.24 Fluorosis

4.25 No health problems

APPENDIX - IV
Kerala Agricultural University
Vellayani

Interview schedule to elicit information on dietary habits
and food consumption pattern

Name of the child: Code No. |‾‾‾‾|

1. Food Habits   : Vegetarian / Nonvegetarian

2. Frequency of meals per day :

3. Dietary pattern of the child for three days

Feedings	Menu
First Day.	

Breakfast

Lunch

Dinner

Second Day

Breakfast

Lunch

Dinner

Third Day

Breakfast

Lunch

Dinner

4. Frequency of use of different food materials

Sl. No.	Food groups	Frequency of use				
		Daily	More than thrice a week	Once a week	Once in month	Never
1.	Cereals					
2.	Pulses					
3.	Roots and tubers					
4.	Other vegetables					
5.	Green leafy vegetables					
6.	Fruits					
7.	Milk and milk products					
8.	Meat					
9.	Fish					
10.	Egg					
11.	Fats amd oils					
12.	Sugar and jaggary					
13.	Bakery items					
14.	Beverages					

APPENDIX - V

Test of Learning Disabilities and Developmental Language Disorder Among School Children

Institute for Rehabilitation of Children with cognitive and communication Disorders (IRCCCD)

Code No. ☐

1. Name of the child   :

2. Age (in years)   :

3. Sex   : M/F

4. House address   :

I. For each child, the following questions should be directly asked to the parent and and answers recorded:

   1. How do your feel about the intelligence of the   ☐
       child from his day to day activities?

       (1 = Above average; 2 = Average; 3 = Below average)

   2. How is the child in his studies?   ☐

       (1 = Above average; 2 = Average; 3 = Below average)

   3. Is he/she highly distractible in class?   ☐

       (2 = Yes;   1 = No)

   4. Does he/she engage in physically dangerous   ☐
       activities without thinking of possible
       consequences?

       (2 = Yes;   1 = No)

   5. Does he/she show any difficulties in   ☐
       articulation?

       (2 = Yes;   1 = No)

6. Does he/she have the problem of shuttering?   ⬚

    (2 = Yes; 1 = No)

7. Does he/she ask for repetition in the class?   ⬚

    (2 = Yes; 1 = No)

8. Is he/she finding it difficult to understand   ⬚
    the intonations of speech?
    (1 = Yes; 2 = No)

9. Does he/she use limited vocabulary?   ⬚

    (2 = Yes; 1 = No)

10. Is he/she having an immature sentence   ⬚
    structure?
    (2 = Yes; 1 = No)

11. Does he/she show difficulty in understanding   ⬚
    complex commands?
    (2 = Yes; 1 = No)

12. Is he/she converse with the social use of   ⬚
    language?
    (1 = Yes; 2 = No)

13. Is he/she conveying the proper meaning when   ⬚
    he is answering questions?
    (1 = Yes; 2 = No)

14. Is he/she able to recall things heard?   ⬚

    (1 = Yes; 2 = No)

15. Is he/she slow in writing?   ⬚

    (2 = Yes; 1 = No)

16. Is he/she showing inaccurate phrasing,   ⬚
    reversal of words?
    (2 = Yes; 1 = No)

17. Does he/she has normal writing skills?   ⬚

    (1 = Yes; 2 = No)

18. Is he/she finding it difficult to connect
    logically the learned materials?
    (1 = Yes;   2 = No)

    ☐

19. Is he/she clumsy?

    (2 = Yes;   1 = No)

    ☐

20. Does he know comprehensive writing?

    (1 = Yes;   2 = No)

    ☐

21. Does he/she use the proper grammar?

    (1 = Yes;   2 = No)

    ☐

22. Is he/she finding it difficult to master
    multiplication tables?
    (1 = Yes;   2 = No)

    ☐

23. Does he/she use incorrect problem solving
    strategies?
    (1 = Yes;   2 = No)

    ☐

24. Is he/she showing markedly less socialisation
    and communication behaviour?
    (2 = Yes;   1 = No)

    ☐

25. Is he showing stereotype activity
    unintentionally
    (2 = Yes;   1 = No)

    ☐

26. Does he/she has the tendency to loose their
    necessary things from home and school?
    (2 = Yes;   1 = No)

    ☐

27. Is there any history of epilepsy or have
    you ever observed sudden shaking of arms
    or legs with fall to the ground?
    (2 = Yes;   1 = No)

    ☐

28. Has he/she ever lost consciousness or lost
    contact with surroundings briefly and
    behaved abnormally
    (2 = Yes: 1 = No)

    ☐

I. Answer the following questions has to be derived from the responses of the child by investigator

1. Can he/she comprehend the read materials?

   (1 = Yes;   2 = No)

2. Does he/she show letter by letter slow reading?
   (2 = Yes;   1 = No)

3. Does he/she show omissions, commissions or substitutions while reading?
   (2 = Yes;   1 = No)

4. Is he/she able to identify the location and places on the map?
   (1 = Yes;   2 = No)

5. Can he/she identify simple geometric figures?

   (1 = Yes;   2 = No)

6. Does he/she give undue pressure on hands while writing?
   (2 = Yes;   1 = No)

7. Does he have atrocious spellings?

   (2 = Yes;   1 = No)

8. Is he/she showing reversal of numerals?

   (2 = Yes;   1 = No)

9. Is he/she showing difficulty in understanding mathematical symbols?
   (2 = Yes;   1 = No)

10. Does he/she make mistake in telling time?

    (2 = Yes;   1 = No)

IIIa. Writing to dictation - Malayalam Alphabets

----

1.   2.   3.   4.   5.   6.

----

7.   8.   9.   10.   11.   12.

----

13.   14.   15.   16.   17.   18.

----

19.   20.   21.   22.

----

b. Writing in dictation - English (Capital letters)

----

1.   2.   3.   4.   5.   6.

----

7.   8.   9.   10.   11.   12.

----

13.   14.   15.   16.   17.   18.

----

c. Writing in dictation - English (Small letters)

----

1.   2.   3.   4.   5.   6.

----

7.   8.   9.   10.   11.   12.

----

d. Writing dictation – Malayalam words

---

1.   2.   3.

---

4.   5.   6.

---

7.   8.   9.

---

10.   11.   12.

---

e. Writing to dictation – English words

---

1.   2.   3.

---

4.   5.   6.

---

7.   8.   9.

---

10.   11.   12.

---

13.   14.   15.

---

f. Arithmetics
a. Mental calculations - Addition/Subtraction

---

1.   2.   3.

---

4.   5.   6.

---

b. Multiplication

---

1.   2.   3.

---

4.   5.   6.

---

c. Write numbers

---

1.   2.   3.

---

4.   5.   6.

A sample of the Raven's CPM Test

A2

1   2   3

4   5   6

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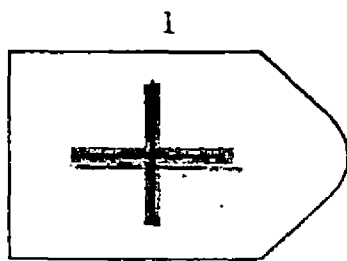
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SET B

B1

SET AB

A_B 1

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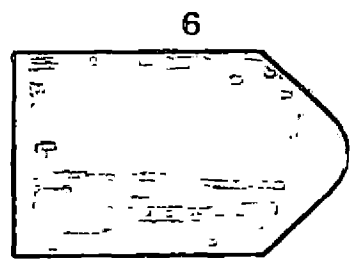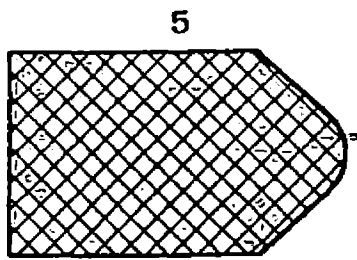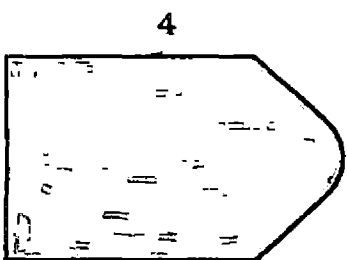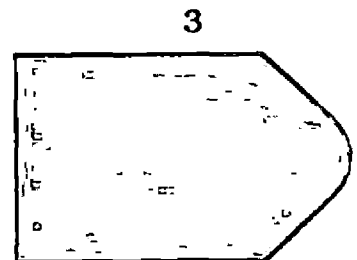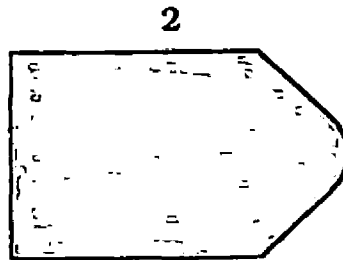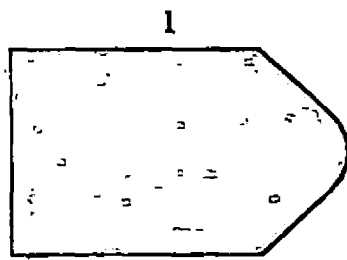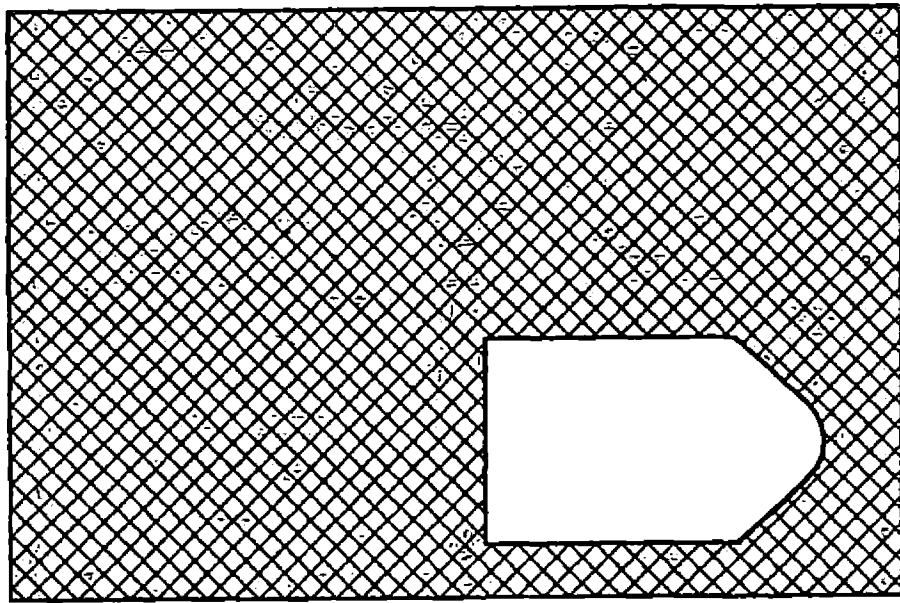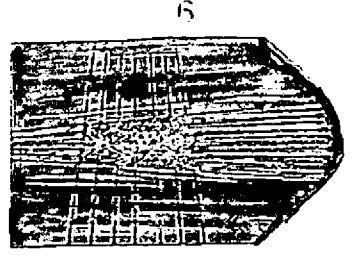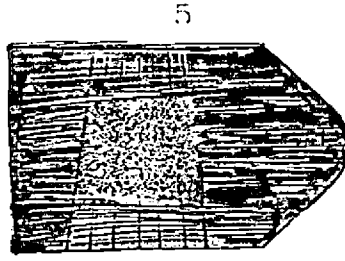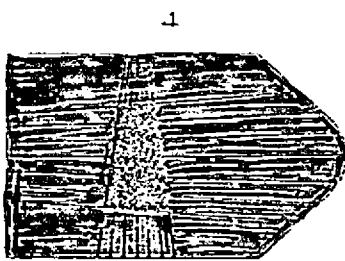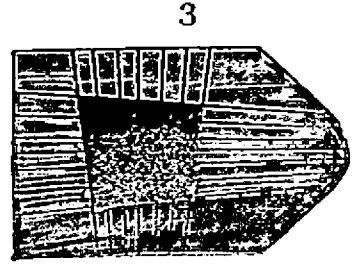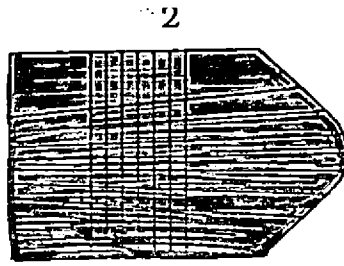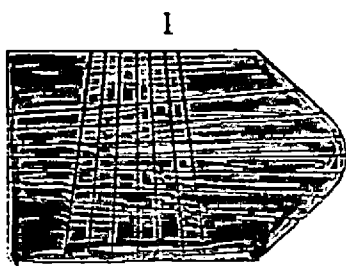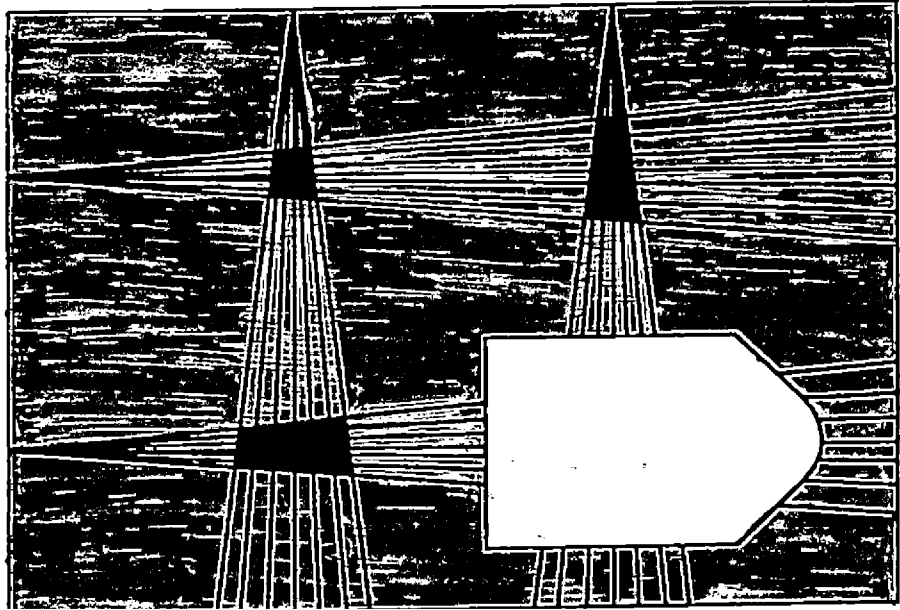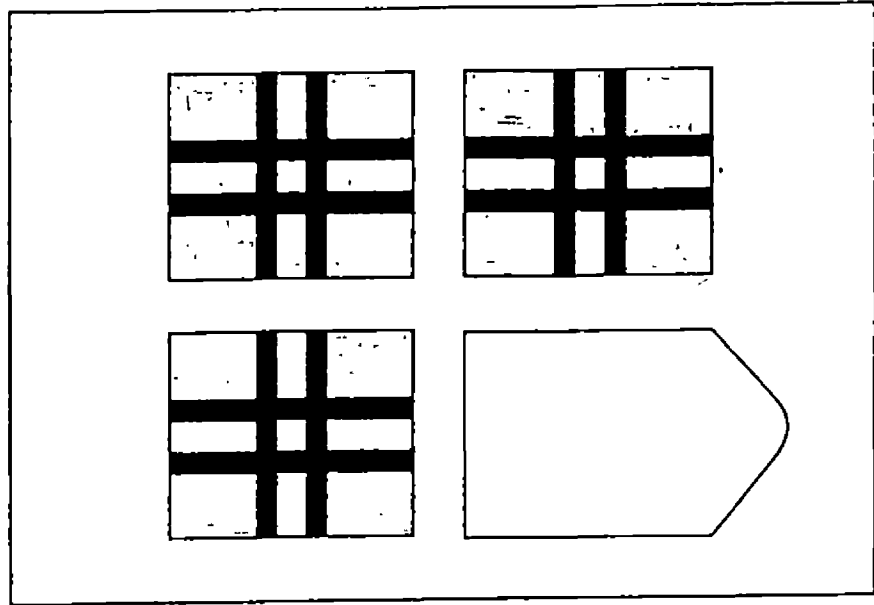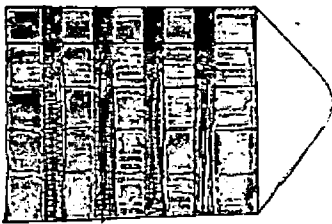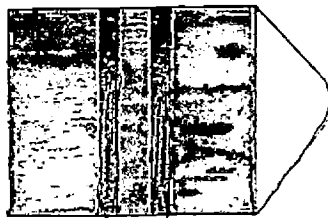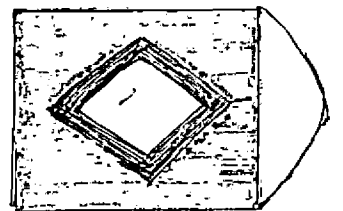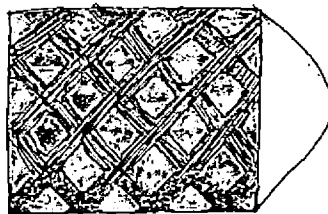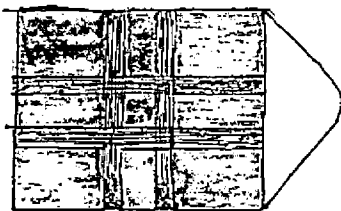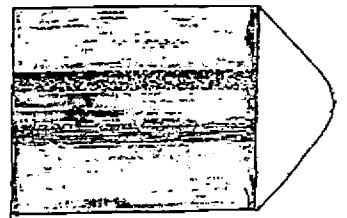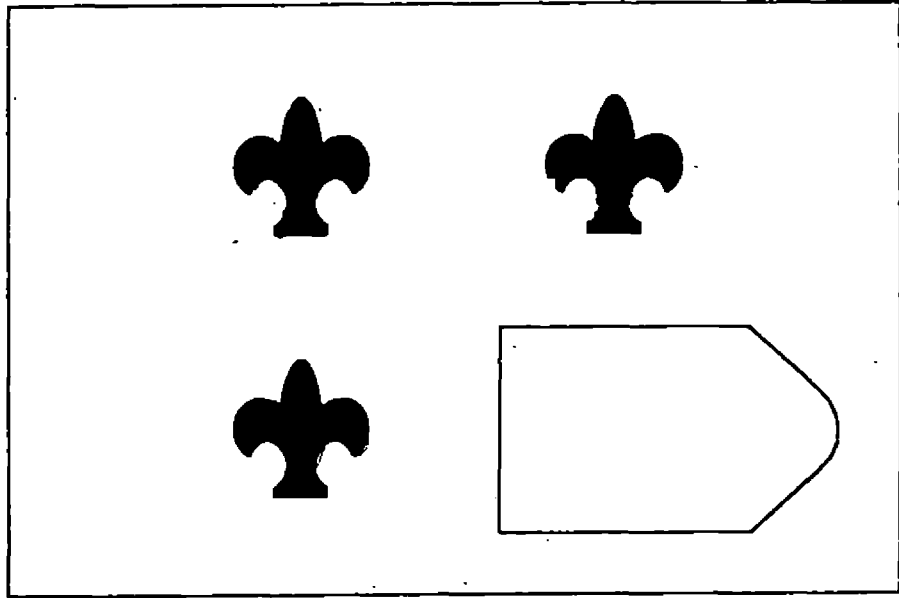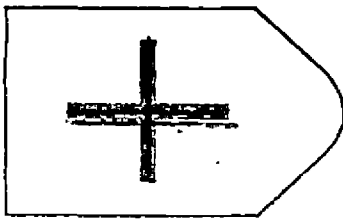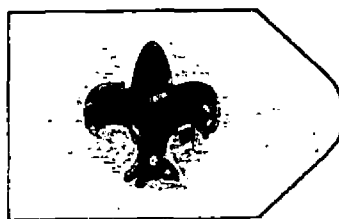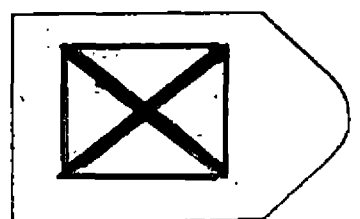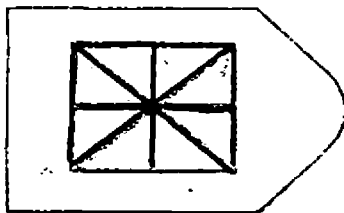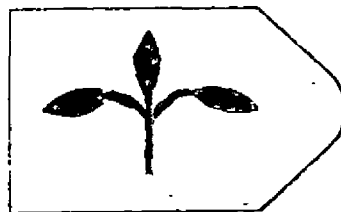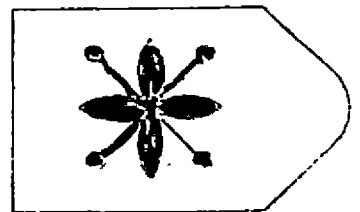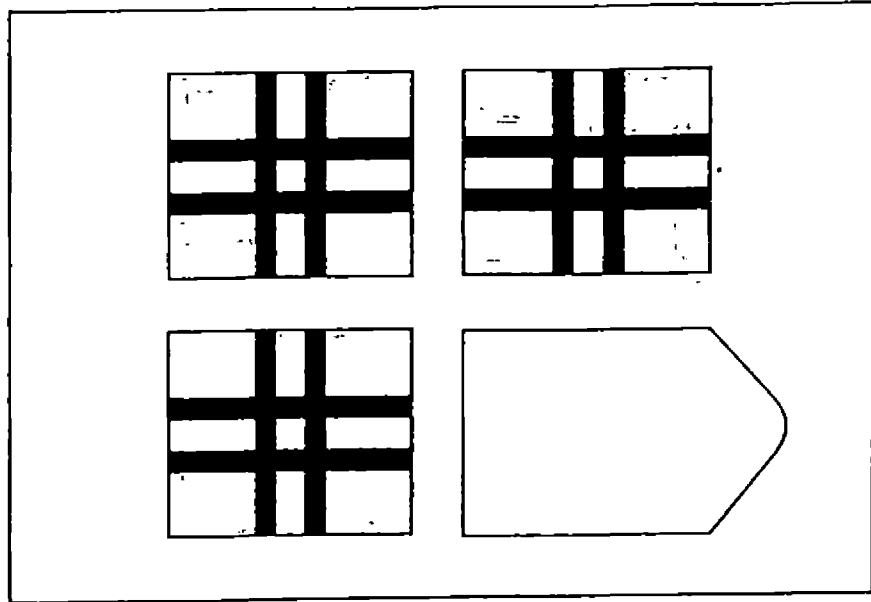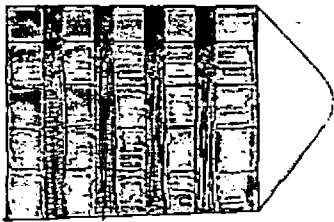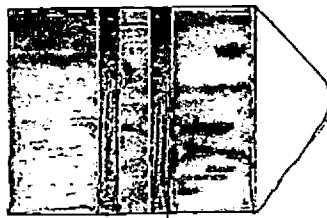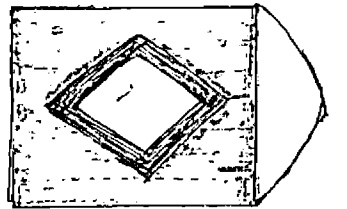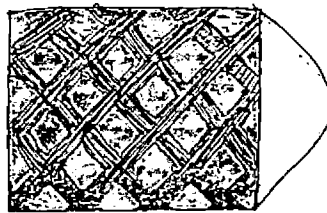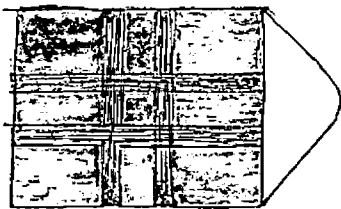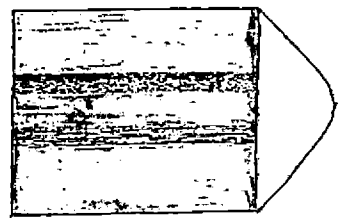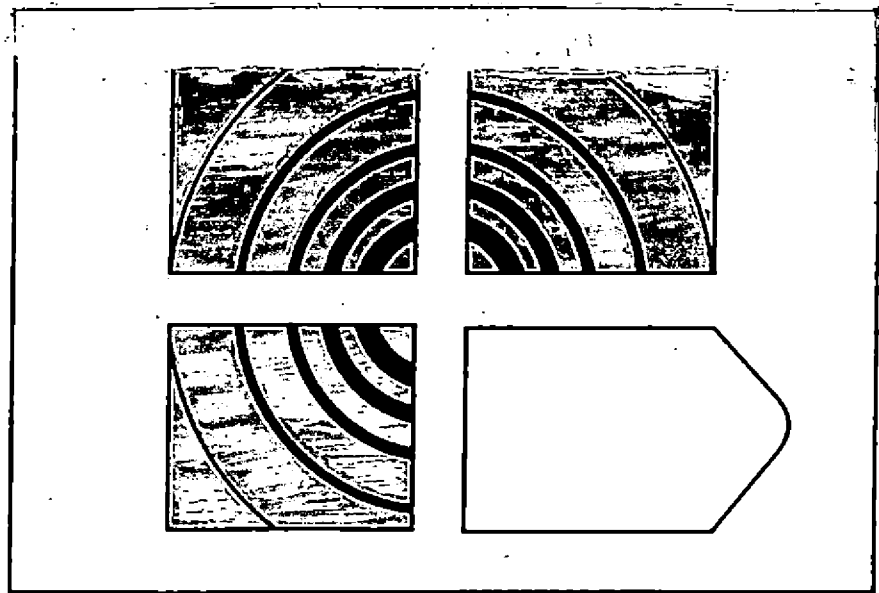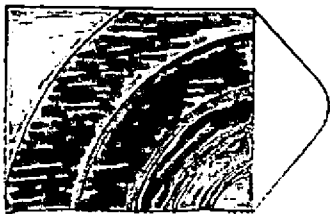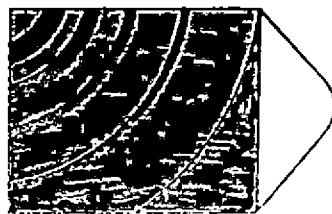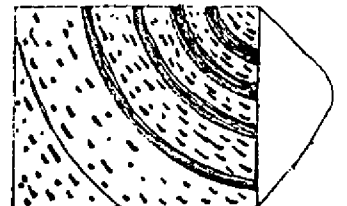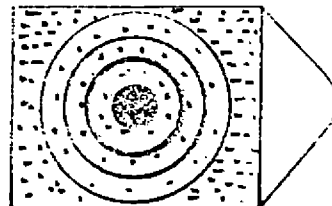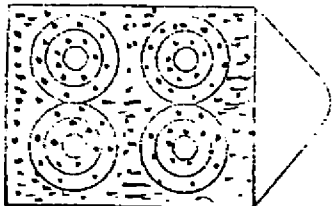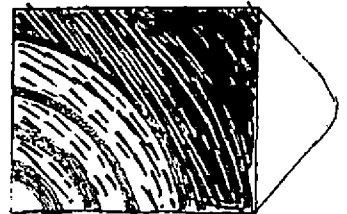
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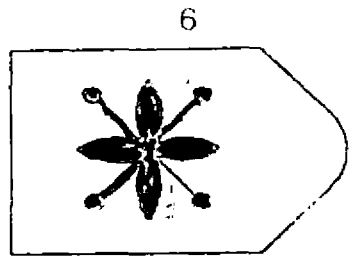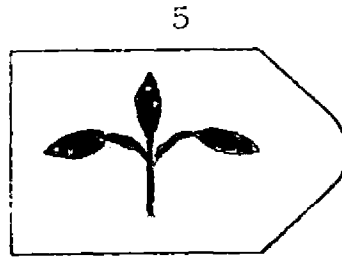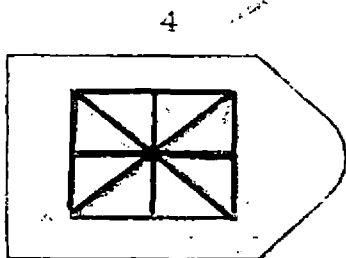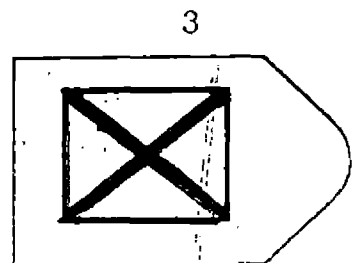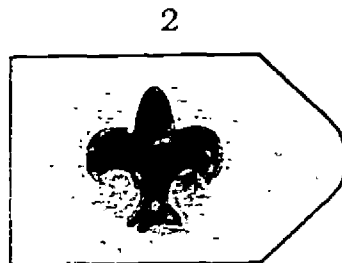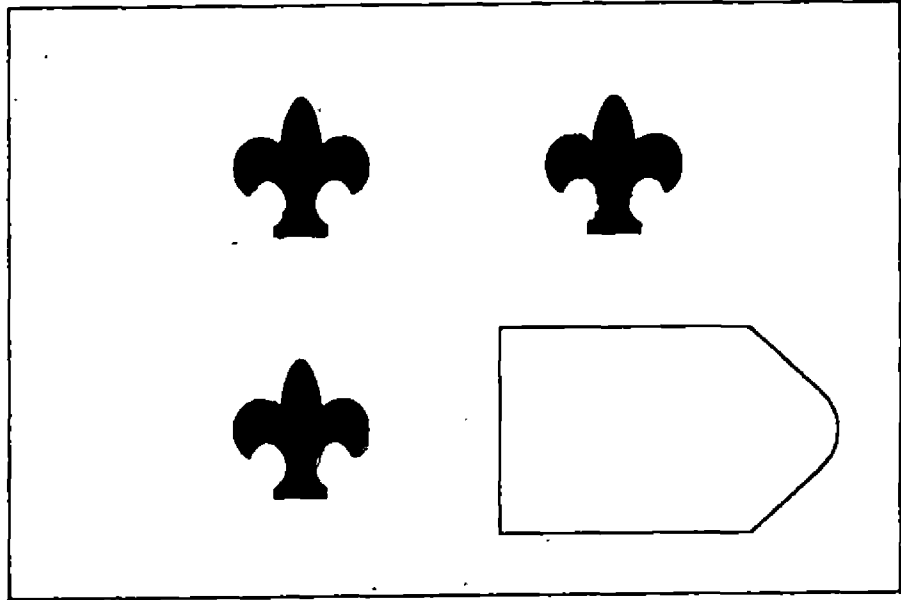
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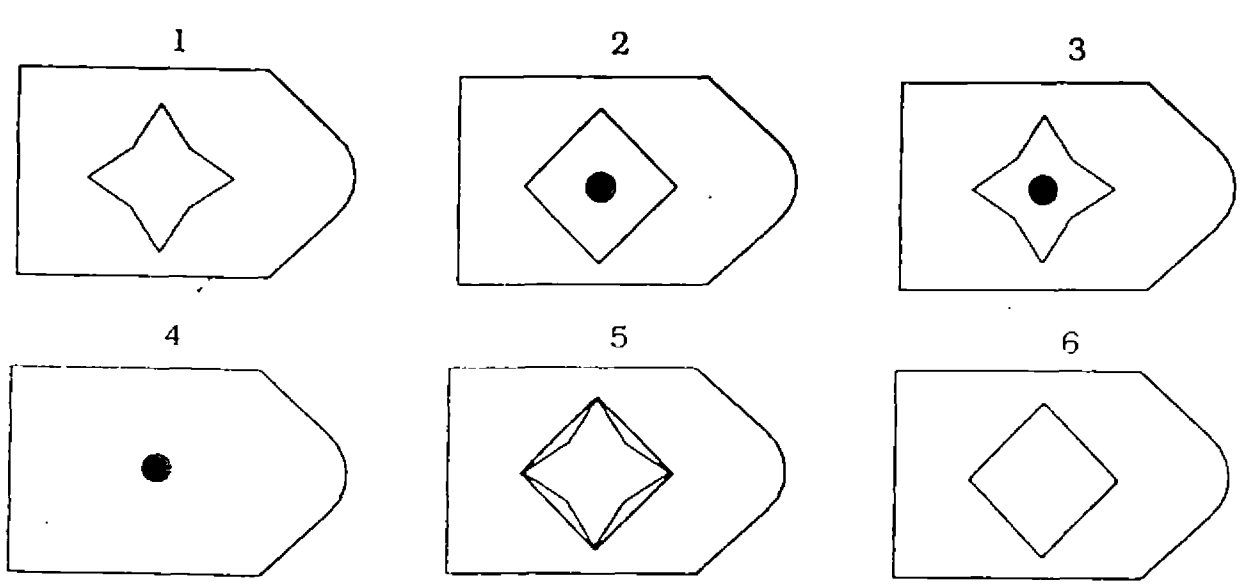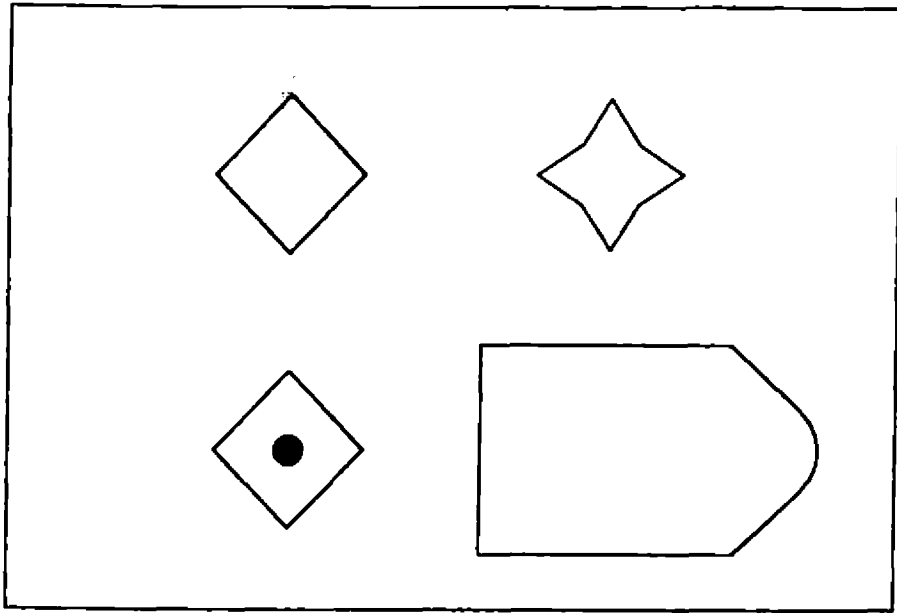
Appendix – VI continued

Coloured Progressive Matrices Test Sheet

Sets A. Ab. B

Name_____ . _____   Ref. No._____ ....

Place _____   Date_____ .

Age _____   Birthday_____ .

Test begun _____   Test ended_____

A			Ab			B		
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		

NOTES :—

TOTAL	GRADE

APPENDIX - VII

A sample of Draw-a-Man Test Sheet

Name: Date:

Age :   Yrs.   Months   Days

Scoring point	Score

Eyes
Nose
Mouth
Head
Forehead
Chin
Ears
Hair
Face
Neck·
Trunk
Arms
Palm
Fingers
Legs
Feet and Toes
Proportion of leg
Proportion of feet
Proportion of head
Motor control
Dress
Bust
Full figure

Total

Calculated age: Yrs.   Months   I.Q.

Mental age: Yrs.   Months   Raw score

Percentile Rank

APPENDIX - VIII

Kerala Agricultural University
Vellayani

Schedule for Teacher's Assessment of Childs Overall Development

Code No. |___|

1. Name of the child   :

2. Age (in years)   :

3. Class of study   :

4. Name of school   :

5. Name of Teacher   :

1. Physical development

1.1 Activity level   - Very |___| Less |___| Lethargic |___|
                         active   active

1.2 Stamina   - Good |___| Average |___| Poor |___|

1.3 Physical   a) Fat |___| Medium |___| Thin |___|
     appearance

                   B) Tall |___| Medium |___| Short |___|

1.4 Visual ability   Normal |___| Defective |___|

1.5 Auditory ability   Normal |___| Defective |___|

1.6 Orthopaedic condition Normal |___| Defective |___|

2.   Motor Development

2.1 Large Muscular   Good ☐ Average ☐ Poor ☐
     Co-ordination

2.2 Finer Muscular   Good ☐ Average ☐ Poor ☐
     Co-ordination

3.   Emotional Development

3.1 Emotional   Spontaneous ☐ Restrained ☐ None ☐
     expression

3.2 Emotional   Frequent ☐ Sometimes ☐ Never ☐
     outbursts

3.3 Dominant emotions: Frequent   Sometimes   Never

3.3.1 Joy   ☐   ☐   ☐

3.3.2 Affection   ☐   ☐   ☐

3.3.3 Fear   ☐   ☐   ☐

3.3.4 Anger   ☐   ☐   ☐

3.3.5 Jealousy   ☐   ☐   ☐

3.3.6 Hostility   ☐   ☐   ☐

3.3.7 Grief/Sorrow   ☐   ☐   ☐

4.   Social Development :   Mostly   Sometimes   Never

4.1   Friendly   ☐   ☐   ☐

4.2   Co-operative   ☐   ☐   ☐

4.3   Leads the groups ☐   ☐   ☐

4.4   Follows the leader ☐   ☐   ☐

4.5   Humourous   ☐   ☐   ☐

4.6   Competitive   ☐   ☐   ☐

4.7   Aggressive   ☐   ☐   ☐

4.8   Selfish   ☐   ☐   ☐

4.9   Responsible   ☐   ☐   ☐

4.10   Independent   ☐   ☐   ☐

4.11   Attention seeking ☐   ☐   ☐

4.12   Obedient   ☐   ☐   ☐

4.13   Good mannered   ☐   ☐   ☐

5.	Language Development :	Mostly	Sometimes	Never
5.1	Talks freely	☐	☐	☐
5.2	Speaks in words	☐	☐	☐
5.3	Speaks in sentences	☐	☐	☐
5.4	Questions freely	☐	☐	☐

5.5	Vocabulary	Good	☐	Average	☐	Poor	☐

6.	Intellectual development	Good	Average	Poor
6.1	Attention span	☐	☐	☐
6.2	Memory	☐	☐	☐
6.3	Curiosity	☐	☐	☐
6.4	Creativity	☐	☐	☐
6.5	Reasoning	☐	☐	☐
6.6	Logical thinking	☐	☐	☐

7. Concept development	Good	Average	Poor
7.1 Time	☐	☐	☐
7.2 Space	☐	☐	☐
7.3 Number	☐	☐	☐
7.4 Colour	☐	☐	☐
7.5 Form and size	☐	☐	☐
7.6 Direction	☐	☐	☐

8. Participation in extracurricular activities   Sports ☐   Arts ☐   Literary activities ☐

9. General opinion on overall development activities   Good ☐   Average ☐   Poor ☐

LEARNING DISABILITIES IN MALNOURISHED CHILDREN

BY

SANDHYA CHANDRAN

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN HOME SCIENCE
(FOOD SCIENCE AND NUTRITION)
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM

2001

ABSTRACT

The study entitled "Learning Disabilities in Malnourished Children" undertaken in the rural areas of Trivandrum district was conducted to study the relative effect of malnutrition on the learning disabilities of children between five to ten years.

The study was carried out in Trivandrum district among children between five to ten years selected from three Lower Primary Schools, a Primary Health Centre and Institute of Rehabilitation of children with Cognitive and Communication Disorders (IRCCCD), a sister concern of Sree Chithra Thirunal Hospital, Medical College. The sample for the study comprised of a total of 240 subjects, divided into five groups of top, average, low rankers, malnourished group and learning disabled group.

The variables selected for the study were grouped into dependent and independent ones for convenience of statistical analysis. The dependent variables in the study included the assessment scores of LD, nutritional status, intelligence and overall development. While the independent ones consisted of those regarding demographic, socio-economic, developmental, health and nutritional as well as dietary aspects.

The results in course of this investigation revealed the following salient findings.

i)   The demographic and socio economic status of the subjects studied revealed a heterogenous group of rural population, ranging from low to middle. socio-economic background with random representation of the three religions viz; Hindu, Christian and Muslim and predominently from backward caste.

ii)   The health and developmental history showed comparatively high prevalence of low birth weight, premature babies to lesser duration of breast feeding and with higher incidences of illnesses, developmental and behavioural problems, among the groups comprised of low rankers (Group III). malnourished (Group IV) and learning disabled subjects (Group V).

iii)   The food consumption pattern indicated that majority were non-vegetarians with half of the sample consuming inadequate diet (51.00 per cent). Cereals constituted the bulk of the diet. followed by daily consumption of fish, milk and milk products, vegetables, oil and sugar. Leafy vegetables and meat were consumed only in a very small quantity and rarely too. This agrees with the dietary

consumption pattern of rural Keralites. More inadequacy
in nutritional status was shown by low rankers and
malnourished subjects when compared to top and average
rankers and LD subjects.

iv) With respect to the prevalence of LD, intelligence
malnutrition and overall development of the subjects, the
high and average rankers showed better nutritional status,
intelligence, overall development and low LD score,
compared to low rankers, malnourished and LD subjects.
But the clinically identified LD subjects had better
nutritional status and overall development than others
though they scored poorly in intelligence and high in LD.

v) Statistical analysis revealed that Group I of top rankers
showed better intelligence, overall development and low
incidence of LD. While in the case of nutritional status
Group V topped the others, since most of them were from a
better demographic and socio-economic background. Also
the variation regarding the major scores, was negligible
between Group III and IV ie low rankers and malnourished
subjects.

vi) The dependent variables studied such as LD, nutritional
status, intelligence and overall development showed
significant relationship with independent variables like

age (except with overal. ......pment), parents'
educational status, number of siblings, birth weight and
breast feeding duration (except with LD score), clinical
symptoms, history of illness, problems of development and
behaviour. In the case of LD score and overall
development score, the relationship was in the negative
direction. Surprisingly, in this present study income did
not show any relationship with LD and intelligence.
Further LD showed negative correlation with nutritional
status or malnutrition.

vii) It was also observed from the study that certain discrete
independent variables and demographic and social variables
like, sex, religion, caste and mother's employment status,
have significant association with LD while all the other
developmental and dietary variables, except for diet
adequacy have insignificant association.

Thus the result in sum suggest that LD is not merely
genetical but factors in the environment like demographic and
social factors, health, dietary and developmental factors have
also an impact. Moreover nutritional status, intelligence,
overall development and LD are interrelated. Further research in
these areas are recommended before making any concrete
generalisation.