

**DEPARTMENT OF COMMUNITY HEALTH  
FACULTY OF MEDICINE  
ADDIS ABABA UNIVERSITY**

**RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND  
MENTAL DEVELOPMENT OF CHILDREN IN  
Elka Na Mataramofa, East Showa.**

**A Thesis presented to The School  
Of Graduate Studies Of Addis Ababa  
University.**

**In partial fulfilment of the requirements for  
the Degree of Master of Public Health.**

**BY: SOUCI MOGGA, MD  
MAY 1996**

ADDIS ABABA UNIVERSITY  
SCHOOL OF GRADUATE STUDIES

**Relationship Between Nutritional Status and mental Development of  
Children in Elka Na Mataramofa, East Showa**

By

Souci Mogga, MD

**Department of Community Health**  
Faculty of Medicine, Addis Ababa University

Approved by the Examining Board

Dr. Derege Kebede  
Chairman, Department  
Graduate Committee



Dr. Tadesse Alemu  
Advisor



Prof. G.A. Ashitey  
Examiner



Dr. Mekonnen Assefa  
Examiner



Dr. Negussie Taffa  
Examiner



## **Acknowledgements**

Financial and material support for the study was obtained from the Borena Health and Nutrition Study Project (BHNS) and the Department of Community Health (DCH).

The guidance, advice and encouragement of my principal advisor Dr. Tadesse Alemu and my secondary advisor Dr. Fisseha Eshetu has been important to this study.

I also benefited from the unlimited assistance of W/O Gilinesh Haile, Ato Fikre Enqusellassie, Dr. Birhanu Demeke and Dr. Yemane Berhane.

I would like to thank Ato Alemu Asfaw from the Food Security Research Project, Ato Yohannes Kinfu from Demographic Training and Research Centre Addis Ababa University for their continuous help and support.

I would also like to thank Prof. Frances E. Aboude from the Department of Psychology, McGill University, Canada, For her continuous support and comments. And also the people of Elka for their cooperation.

Data collectors carried out their task superbly. The help of W/O Atsede Asfaw was also so important in secretarial assistance.

Had it not been for all these, this paper could not have materialized. To them all, I am indebted, and extend due respect and thanks!

<b>Table of Contents</b>	<b>Page</b>
Acknowledgements . . . . .	i
Table of Contents . . . . .	ii
List of Tables . . . . .	iii
List of Appendices . . . . .	iv
Abbreviations . . . . .	v
Abstract . . . . .	vi
Introduction . . . . .	1
Literature Review . . . . .	5-16
Nutritional measures . . . . .	5
Prevalence of malnutrition . . . . .	7
Malnutrition and mental development . . . . .	9
Assessment of mental development . . . . .	14
Objectives . . . . .	17
Methods . . . . .	18
Results . . . . .	25
Discussion . . . . .	41
Conclusion and recommendation . . . . .	46
References . . . . .	47
Appendices . . . . .	55

**List of tables**

	Page
Table 1. Sociodemographic characteristic of households. Elka. 1996 . . . . .	27
Table 2. Maternal sociodemographic and birth related characteristics . . . . .	28
Table 3. Demographic and nutritional status of the study children. Elka. 1996 . . . . .	31
Table 4. Distribution of nutritional status by age group and sex. Elka. 1996. . . . .	32
Table 5. Nutritional status of children according to Waterlow classification. Elka. 1996. . . . .	32
Table 6. Bayley mental score in relation to demographic and nutritional characteristics. Elka. 1996 . . . . .	34
Table 7. Mean and standard deviations of Bayley score in different nutritional status. Elka.1996. . . . .	35
Table 8. Mean and standard deviations of Bayley score in different sociodemographic characteristics of the households. Elka. 1996 . . . . .	37
Table 9. Correlations of anthropometric measurements and Bayley mental score with thier correlation coefficient and 2 tailed significance. Elka. 1996. . . . .	39
Table 10. Correlations of anthropometric measurements with thier correlation coefficients and 2 tailed significance. Elka. 1996 . . . . .	39
Table 11. Multiple regression predictors of Bayley mental score and their Beta weight. Elka.1996 . . . . .	40

**List of appendices**

	page
Appendix 1 Methods of anthropometric measurements . . . . .	55
Appendix 2 An English version of questionnaire . . . . .	56
Appendix 3 Amharic version of the questionnaire . . . . .	60
Appendix 4 Answer sheet . . . . .	66

**List of abbreviation**

ANC	Ante natal care
BMI	Body mass index
GNP	Gross national product
HAZ	Height for age Z score
H/A	Height for age
NCHS	National centre for health statistics
U.S.A	United States of America
UNICEF	United nation's children fund
WHO	World health organization
WHZ	Weight for age Z score
WAZ	Wight for height Z score

**Abstract**

Malnutrition is one of the major problem in the world particularly in developing countries and it is endemic in Ethiopia. Different studies have showed that severe malnutrition during infancy negatively affects mental development. Most malnutrition begins in the second year of life, and most of it is chronic and mild to moderate in severity. This is why the current study is looking at even mildly malnourished children 1 - 4 years of age.

To assess the mental development of children in relation to their nutritional status , 111 children 12 - 42 months of age from a single peasant association were taken in this study. From these children 49.5% were under weight , 52.2% were stunted and 9.9% were wasted. The mean Bayley score was 88 and SD 13. Most (71.2%) scored 76 - 101.

The mean Bayley score between those stunted and non-stunted showed a significant difference. Multiple linear regression also showed H/A significantly related to mental development. In addition to nutritional status, birth order and delivery events were shown to have strong relation to mental development. Therefore we recommend an extensive health education on nutrition, expansion of delivery services to the rural population and further research on mental development of children with emphasis on the effect of family interaction and child rearing practice on mental development.

## INTRODUCTION

Malnutrition is one of the major health problems in the world. It accounts for as much as a quarter of deaths among children in association with infection and as a direct cause, it shares 3.4% of the global burden of disease and 6% of the total burden of illness in young children (1).

In the developing world, malnutrition is one of the leading causes of mortality and morbidity. It is widespread and endemic in all developing countries and may reach epidemic proportions as a consequence of natural and/or man-made disasters (2). It is estimated that 40 million preschool children in developing countries are living in a condition of acute malnutrition, and more than three times this number in a chronic state of inadequate nutrition and associated illness (3).

The problem is worse in most African countries where living conditions are worse than other countries with low economic development. This is further worsened by poor health care, scarcity of resources, political instability and rapid population growth that does not match the socioeconomic growth (4).

Ethiopia is one of the least developed low income countries with average annual population growth of 3.1%, GNP per capita of 120 US dollars (5), and with only 47% of the population having access to health facilities (6). Children under five years constitute 18% of the total population (6), yet of all

deaths in Ethiopia more than half are children under five years of age (6,7). The most common cause of child death is the interacting combination of malnutrition and infection (8).

Children are the most vulnerable group in any society. Their growth is mainly influenced by genetic programming and external influences. Nutrition is one of the external factors which influence growth and attainment of normal body dimension (9). It serves to meet the requirement for cell multiplication and for the process in which the growing tissues and organs take an increased complexity of function (10).

The level of nutrition is influenced directly by dietary intake and indirectly by the effect of infection, parasites, toxic and/or psychological stresses (11). The nutritional status of children in Ethiopia is mainly influenced by feeding practices and by the frequency of infection (12).

Malnutrition has an immediate effect such as death and morbidity from a severe case and, in childhood where there is rapid growth, it has a long term effect on the well-being of the individual. Unfavourable condition during rapid growth periods can be expected to retard development and result in reduced physical growth and impaired mental and psychosocial development which may affect working capacity in a later life. Thus severe malnutrition in infancy is said to affect mental development (10,13).

In the fight against malnutrition, survival is the main concern. But there is the possibility of an increment in the number of survivors of malnutrition who may have impaired learning abilities affecting their future life.

Since children are the economic assets to the world and their future developmental outcome can be influenced by their nutritional status, the mechanism and the consequences of malnutrition need to be understood better. This being more true in a country like Ethiopia where malnutrition is almost universal, there is a need to identify the relation between nutritional status and mental development of children so that interventions can be planned to enable them to achieve optimum growth and development.

In Ethiopia, some studies have been made on the physical aspect of malnutrition, but only one community based study on its effect on mental development. Therefore, it is relevant and timely to carry out a community based study in rural Ethiopia where more than 80% of the population live and where the magnitude of malnutrition is higher.

Many studies have found that severe malnutrition in infancy negatively affect mental development. But as it is the case in Ethiopia, prevalence of malnutrition peaks in the second year of life and most of it is chronic, and mild to moderate in severity. This is why the current research is looking even at mildly malnourished children 1 to 4 years.

The study is thus designed to determine the relationship between nutritional status and mental development in children, and the result obtained may be used by policy makers and programme managers in different parts of the country.

## LITERATURE REVIEW

### Nutritional assessment

Direct nutritional assessment of a community depends on biochemical tests, clinical examination and anthropometric measurements. Biochemical tests need laboratory facilities and are usually costly, time consuming and the results are difficult to interpret, so they need to be performed in well equipped health facility. To use clinical signs for nutritional assessment is inexpensive, fast and does not require highly qualified staff, but it is subjective and, clinical signs may not appear at an early stage of malnutrition (9,11).

Anthropometry is the most commonly used direct method for the assessment of nutritional status. The frequently employed anthropometric measurements are weight and height. Anthropometric measurements have the inherent potential for inaccuracy, require precise age, have limited nutritional diagnostic capabilities and there is some controversy in the selection of appropriate reference data. On the other hand, they are economical to carry out, objective, easily understandable, gives result which can be numerically graded and provides information on different degrees of malnutrition. Therefore, most studies on nutritional status are performed using anthropometric measurements(11). They have been used as indices of nutritional status of an individual and the community (14).

Child growth and the size of adults reflect the effect of diet, infection, psychosocial and genetic factors. Indirectly, it reflects agricultural and economic influences.

Anthropometric measurements are used to detect growth faltering and under-nutrition by comparing the measurements with reference data. International standards which are based on the growth of children in developed countries are used as reference to compare the child's growth. Some argue that local standards are preferable because they take into account genetic and ethnic differences. However, some studies have shown that environmental factors have more influence than genetic difference (11,15).

It has been shown that African infants usually thrive during the first six months of life and their growth curves resemble those of their European counterparts (16). However, various environmental factors including nutrition are responsible for the eventual deterioration in their growth during the second half of infancy, which coincides with the time when breast milk is unable to provide the nutritional requirement of the rapidly growing child (16).

Studies in Ethiopia showed that children follow the same weight increment pattern as children of the same age in developed countries up to the age of 6 months, after which it deteriorates. Some studies revealed that height also has a gradual downward deviation with increasing age(8).

### **Prevalence of Malnutrition**

There is no reliable estimate on the extent of malnutrition in the world. However, it has been estimated that, in the world as a whole around 100 million infants and small children are moderately to severely underweight (below 75% of reference weight for age). Of these, 10% are below 60% of the reference weight, which implies an acutely life threatening situation for these infants and toddlers (17).

Each day, more than 40,000 young children in the world die from a combination of malnutrition and infection. For every child who dies, there are six children living in hunger and ill health, which may have a long term damaging effect on their lives (18).

Malnutrition is important both as an underlying and contributory cause of child mortality in developing countries. WHO and UNICEF have estimated that malnutrition is a contributing cause in one third of all children deaths.

In developing countries, 12% of children under 5 years of age suffer from acute malnutrition and almost 40% suffer from chronic malnutrition (18).

Findings from the 1992 national rural nutrition survey in Ethiopia shows the prevalence of chronic malnutrition to be more common than acute malnutrition and has increased significantly since 1983 in most regions. Stunting was found in 64.2% of all children, making it the third highest prevalence in the world;

it is common among infants 6-12 months of age (56.5%), and reaches peak (72.7%) among 12-23 months old. Wasting affects 8% of all children in post harvest season, with a peak (11.7%) at 12-23 months of age. Underweight affects 47.7% of all children and the peak is among those aged 12-23 months. In all three anthropometric indicators, male children are more affected than female. It is found that breast feeding is universal and continues for a median of 25-30 months and the median age for complementary food introduction was 7.1 months. There was strong association between median age of introducing complementary food and prevalence of stunting among young children (19).

Cell mediated immunity , elimination of pathogens and tissue repair are all likely to be affected by the nutritional state (20). Because of this, case fatality rate of diseases becomes high in malnourished children (1,21,22). Conversely, diseases can be contributory factors in the development of malnutrition.

The difference between a well nourished and malnourished children is not just in their anthropometry, but also in the relative proportions of various organs, tissues and in chemical composition like water, protein, fat and minerals. Malnutrition has an effect on structure and function of the different organs including cardiovascular, haemopoetic, hepatic, pancreas, gastrointestinal tract, kidney, skin and hair and the nervous system (23).

### **Malnutrition and mental development**

Child development involves changes in a child's biological, social, cognitive and emotional dimensions. This is determined both by genetic and environmental factors (24).

There is a normal pattern of growth and development with a range at a particular age in which children reach a certain height, weight or ability to walk or talk. Growth is generally a smooth process in a healthy child (9).

The genetic endowment provides a range of possible levels one may ultimately reach, depending on the quality of the experience in the environment (25). A variety of environmental factors including nutrition, disease, and psychological disturbances affect growth (26).

Malnutrition is a common health problem in the developing world, the tragedy of which may lie in the damage it inflicts on the growing brain. Under-nutrition is said to have a serious impact on child health and development affecting motor capabilities, perceptual function, school achievement socio-emotional maturity and may result in reduced working capacity in future life (27).

Neurons, the building blocks of brain, change in size, function and degree of interconnectedness with the child development (27). Along with an increase

in brain size, functional organization of the nervous system takes place, which reflects its increasing responsiveness to stimuli from the environment (28).

As there are physical growth spurts, there is also a neural growth spurt period. This period varies in different animals, in different regions of the brain and different cell types (29,30). If conditions are not optimal at a given time, that opportunity is lost and compensation may be impossible (31). The first neural growth spurt when the number of neurons in the developing brain reaches the adult level is at about 30 weeks of gestation, the second growth spurt occurs in the first postnatal year and 70% of adult brain weight is achieved by the end of the first year (28). By about five years of age the child brain has attained 90 % of its adult size (9). Hence, the period of maximum vulnerability is seen in prenatal and first postnatal months. Nutritional deficiencies particularly those occurring very early in life and coinciding with a time of rapid growth may adversely affect brain development by reducing the rate of brain cell multiplication (13). Therefore, the dietary deficiency will impede brain growth quantitatively, the extent of which depends both on the age of onset, the duration and the extent of the insult (28,31,32).

Studies have shown that malnutrition reduces the number and size of cells in the brain together with the lipid, nucleic acid, enzyme and protein contents (27,28,33,34). An Ethiopian study also demonstrated abnormal transillumination and echoencephalographic changes of the brain in severely malnourished children which showed complete normalization after

treatment(35).

Along with height and weight, head circumference, which is considered as gross brain size, was noted to be reduced in grossly undernourished children during infancy (33,35).

Infants who have suffered from clinically diagnosed marasmus during the first year of life and have been rehabilitated showed evidence of lasting mental deficit when examined at follow up on global measures of intelligence (28). Studies of children who have suffered kwashiorkor in infancy presented varied findings. Some showed that having history of kwashiorkor significantly reduces scores on intelligence test (34). And other studies failed to have significant difference between groups with history of kwashiorkor and the controls (36). Overall, many studies conducted worldwide have shown that early severe malnutrition interferes with intellectual development (37,38,39,40).

Studies of marasmus and kwashiorkor rely on medically diagnosed early life condition, but studies of children with mild to moderately inadequate nutrition have to rely on direct anthropometric measurement(28).

More important, however, is the finding that even mild and moderate malnutrition in children beyond infancy can have a detrimental effect on mental development. Mild to moderate degree of malnutrition was found to influence the mental development and the relative risk of having low

intelligence quotient, and this risk was shown to increase with the severity of malnutrition (41,42,43,44), and stunted children were found to have a lower score than wasted children (41,42).

Temporary food shortage was shown to have affected school children's attentiveness and activity and also reduced the amount of time a mother spends caring for her toddlers (45). In another study missing a single meal have been shown to affect cognitive function of school children who were stunted or wasted, and those who have survived severe malnutrition in early childhood (46).

The effect of malnutrition on boys and girls was found to be different in different studies. In a study done in Nigeria males were affected more by severe malnutrition than females (39), whereas females were more affected, though the correlation were not significantly different, in a Kenyan study (43).

One indirect way in which nutritional deprivation can influence brain development and function is through reduced stimulation, as prolonged apathy, inactivity and weakness due to nutritional inadequacies result in reduced exploratory and stimulating experiences, which are essential to normal development (13,46). Under nutrition is shown to lower exploratory activity, increase the need for physical closeness to the mother, increase time spent sucking the breast and decrease the time spent in playing (47). Thus malnutrition reduces the energy a child has to explore the environment, thus

reducing the stimulation necessary for mental development.

Besides nutrition other environmental factors were also found to be associated with nutritional status and mental development of children (48). Environmental enrichment, in animal study, is shown to be equally important as nutritional status (48). One Jamaican study showed, stimulated malnourished children to be significantly ahead of the non-intervened malnourished children, and only slightly below the adequately nourished children (49). The precise role of the quality of environment in the link between malnutrition and mental development is not exactly known.

Maternal involvement and stimulation was strongly associated with better behaviour and intelligence development and it is claimed to be the most significant environmental factor affecting children mental development (50,51). Maternal nutritional state is said to affect the amount of time they spent caring for their children (42).

Socioeconomic status and educational resource of the family were found to be associated with mental development (40,50,51,52). Child birth order were also said to have an important role (50). But these factors were found to have no influence on rural children in an Indian study (51). Morbidity is the other factor which is strongly incriminated to have an impact on mental development (42).

Because malnutrition is invariably associated with different sociocultural deprivations and these factors independently affect mental development, it is difficult to separate their effect.

### **Assessment of mental development.**

Development tests assess whether a child possesses basic abilities at different stages of development and attempt to measure the current level of functioning (53). Infant development assessment tests such as the Griffith or Bayley scales have been used with young children. One of the widely used test is Bayley scale of infant development that contains different subscales of motor and mental function. The mental and motor scales evolved from 3 California scales. Bayley scale of infant development was first published in 1969 in San Antonio U.S.A. (53). The 2<sup>nd</sup> edition of Bayley scales of infant development was published in 1993, and it is designed for children 1 - 42 months of age (53).

Bayley scale has been used as a complete developmental assessment battery, to chart child's progress after intervention, as a tool for teaching parents about their infant development and as a research tool.

It is an individually administered examination that assesses the current developmental functioning of infants and children. It consists of three scales; mental, motor and behavioral rating scales. The mental scale includes items

that assess memory, habituation, problem solving, early number concept, generalization, classification, vocalization, language and social skills (53).

Items are put within items set by their increasing difficulty. It has basal and ceiling item for each age. Each item contains detailed instruction with all information necessary to administer the items and scoring the responses properly.

Assessment of mental development is very difficult unlike that of assessment of physical development. One of the problems in assessing mental development is the absence of a test appropriate to use in different socio cultural settings. Most developmental tests are used in countries where they are developed. The application of mental development tests to countries with different culture and where there is no standard, require caution in administration of the test and interpretation of the results. Though, the application of these tests to countries with different cultures need caution, they provide valuable information. Consequently they are being used widely throughout the world.

Bayley scale of mental development was used extensively in different parts of the world including Africa (40,42,54). It was also used in a study done in Ethiopia in 1991, and found to be a valid measure of early development in Ethiopian rural children (44).

The present study is designed mainly to assess the mental development of children 12-42 months of age in relation to their nutritional status and identify other related factors.

**General Objective**

To assess mental development of children in relation to their nutritional status.

**Specific Objectives**

1. To describe nutritional status of children 12-42 months in Elka Na Mataramofa Peasant Association.
  2. To determine the mental development of children 12-42 months using the Bayley scale.
  3. To examine the relation between mental development of children and their nutritional status.
  4. To identify other factors related to mental development in children 12-42 months of age.
-

## **METHODS**

### **Study design**

The study utilized a cross sectional design.

### **Study Area**

The Borena Health and Nutrition Study (BHNS) project studies food system, nutrition and disease patterns in drought prone areas of southern Ethiopia. The two study sites for the project are Dubluk in Borena region and Elka Na Mataramofa (Elka) in East Showa.

To keep homogeneity of the study population and to minimize sociocultural differences within the study population one of the villages from the two BHNS sites, Elka, was taken as the study area. Elka was selected for logistic reason. Elka is found in the Rift valley, 15 km north of Zeway town and 145 km south of the capital city Addis Ababa, in Adamitulu woreda, East Showa zone of Oromia region.

Adamitulu Woreda lies within the great rift valley with an average altitude of 1,000 - 1,500 meters. The Woreda has small towns namely Bulbula, Adamitulu and the capital city of the Woreda, Zeway (55). In addition to these small towns, the Woreda has 63 peasant associations, one of which is Elka Na

### **Study population**

All Children 12 - 42 months of age residing in Elka Na Mataramofa were the source population. Since all children 12 - 42 months of age were included in the study, study population is the same as source population. Children aged 12-42 months constitute 8.4% of the total population.

### **Inclusion criteria**

A single child per household who was in age group 12 - 42 month was included in the study. When more than one child per household was found one was selected by lottery method.

### **Exclusion criteria**

Severely sick children who could not participate in the test were excluded.

### **Data Collection**

All the interviews, measurements, observations and testing were conducted at their dwelling compounds of the subjects. Exact age, in month, of each child was taken from BHNS data.

Each child was subjected to medical examination which is carried out by the principal investigator at his/her residence. Children who were acutely sick were excluded from the study.

General information on the family characteristic of the child was collected through house to house visit using questionnaire developed in English and translated to Amharic and pretested (Appendix 3). Mothers knowledge on child development was assessed using four questions on age at which children develop specific skills, which was included in the questionnaire (Appendix 3). Training on how to conduct the interview was given to the interviewers by the principal investigator for one day. Questionnaire was administered to care takers of the Children.

Anthropometric measurement was done for children enrolled to the study by the principal investigator, using standardized procedure to measure weight, height, arm circumference and head circumference (Appendix 1).

Grades of nutrition were assessed using NCHS/WHO standards (57). Weight for age, weight for height and height for age were converted using the anthropometric software package CASP (58). The measurements were related to the reference population by standard deviation scores (Z scores) (57). Children below -2SD of the median were considered under weight, wasted or stunted respectively (57).

Mother's weight and height was measured using standard procedure. And body mass index (BMI) which is, weight for height square ( $W/H^2$ ) was calculated.

Mental development assessment was done using the Second edition of Bayley scale of mental development. Six secondary high school graduates who could communicate well with the local language were recruited and Bayley score training was given by a psychologist who is knowledgeable and experienced on the Bayley scale.

The training took 8 days. Different methods of teaching including lecture, demonstration, practice in small groups, role play and field practice were used. After which three were assigned to be testers and the rest recorders.

In this study, 107 items from the mental scale for children 12 months to 42 months were used which were translated to Amharic, modified for the Ethiopian context by including materials and words familiar to these rural children and by omitting items requiring timing (Appendix 6).

All measurements were done at their dwelling compounds of each child and in the presence of their care takers. Score was given on a separate score sheet by each recorder. The raw score was computed by principal investigator by adding the total number of items for which the child received credit and all items below the basal item. The raw score was then converted to mental development index score by the principal investigator using the second edition of Bayley scales of infant development manual (53). The index score, instead of raw scores, was used to control for age effect.

### **Data management and analysis**

Data entry, cleaning and analysis were done using Statistical package for Social Science (SPSS) (59). Descriptive, bivariate and multivariate techniques were used in the analysis. Correlation and regression analysis were used where appropriate to assess factors associated with child nutrition and mental development, then multiple linear regression analysis was used as main statistical tool. Probability level of less than 0.05 was considered significant.

Socioeconomic status measures included questions about land ownership, possession of cattle, sheep, goats, chicken and type of house they have. Factor analysis, which is statistical technique to identify relatively small number of factors that can be used to represent relationships among sets of interrelated variables, was performed and socioeconomic grades were given for each household depending on these variables.

### **Management**

The study was conducted in November and December 1995. Suitable time for the test was arranged with each mother. Pretesting of the questionnaire was conducted in the nearby village to evaluate its understandability by the respondents.

There was continuous supervision and quality control checks of data by the

principal investigator and by the psychologist. Missing information in a visit were completed with repeated visits.

### **Ethical consideration**

Verbal consent was obtained from the community leaders and care takers. Children with medical problem were given treatment and referrals were made for those requiring further help.

## RESULTS

A total of 285 households were found in Elka Na Mataramofa, out of which 114 (40 %) were found to have children 12-42 months of age. Of these 3 households were excluded because the children were sick. For households who had more than one child in this age group a single child was selected by lottery method. This left 111 children for the study.

### 1. Parental demographic and socioeconomic information

Of the total study population 107 (96.4%) households were headed by males. The majority 106 (95.5%) of head of the households were from Oromo ethnic group and 98.2% spoke Oromigna. One hundred and five of head of the households (94.6%) were Muslims (Table 1).

Most (67.6%) of the children were living in households with five or more family members, and 44 (40%) were living in households with two or more under five children. Care takers of all children were their biological parents (Table 1).

Nearly 96% of the mothers were married and 99.1% were housewives. Most (91.0%) were illiterate and none of the mothers had formal education. The mean age of mothers was 29.6 and SD of 7.77 with minimum of 17 years and maximum of 45 years. Most (72.7%) were between 21-40 years of age. Body Mass Index of the mothers showed, 89.7% of them to be in the normal

range. But, because of cultural reason a question on pregnancy was not answered by most mothers, and only 17 (15.3%) said they were pregnant. This may affect the body mass index (Table 2).

Seventy six (70.4%) of the fathers were between 21-40 years of age. The mean age was 37.8 and SD of 12.99 with minimum age of 20 and maximum age 76 years. And 96.4% (107) were engaged in farming. Fifty six (50.5%) of the fathers were illiterate, 42 (37.8%) can read and write. Of those who attended school, 1 completed elementary school, 10(9%) attended Junior and Secondary high school and only one person completed 12th grade.

Only 1.8% of the families live in corrugated iron roofed house. Thirty three (11.5% ) of the houses have their own pit latrine and only 5 (1.7%) have proper garbage disposal places. Eighty five households (76.6%) had at least a cow or an ox, and 105 households (94.6%) had their own farm plot.

**Table 1.** Socio demographic characteristic of head of households. Elka. 1996.

<b>Characteristic</b>	<b>(N=111)</b>	<b>%</b>
<b>Ethnicity</b>		
Oromo	106	95.5
Kembata	3	2.7
Guragae	1	0.9
Mareko	1	0.9
<b>Language</b>		
Oromigna	109	98.2
Kembatigna	2	1.8
<b>Religion</b>		
Muslim	105	94.4
Christian	6	5.4
<b>Housing</b>		
Thatched	109	98.2
Corrugated	2	1.8
<b>Family size</b>		
2 - 5	63	56.8
6 - 10	46	41.4
≥ 11	2	1.8
<b>Farm plot</b>		
Yes	105	94.6
No	6	5.4

## 2. Age, sex distribution of children and their nutritional status

In the study 53 (47.7%) were male and 58 (52.3%) were females with sex ratio of 90:100. The minimum age was 12 months and maximum age 42 months. Mean age was 25.95 months with SD of 8.45.

Most (47.7%) were between 12 - 23 months of age, 31.5% in 24 - 35 months age group, and 20.7% in 36 - 42 months age group. Fourteen children (12.6%) were 1st born and the rest were second and above (Table 3).

Of the total 111 children 108 (97.3%) were breastfed for at least four months. Additional food was introduced during the 4th to 6th months of age for 24.3% children but the rest (75.7%) were exclusively breast fed for more than six months of life (Table 3).

Fifty five (49.5%) children were underweight ( $< -2$  SD WAZ ). Distribution by sex showed that, 58.5% of males and 41.4% of females were affected. Children 24-35 months of age were affected most and those 36-42 months of age were affected least (Table 4).

Stunting ( $< -2$ SD HAZ ) was found among 58 (52.3%) of children with sex distribution of 54.7% of males and 50% of females. Children aged 24-35 months were affected most and children 36-42 months old were affected least. Among the studied children 11 (9.9%) were small weight for height ( $< -2$ SD WHZ) from which 6 were males. Those 36-42 months of age were affected

most. In all anthropometric measurements, males were more affected (Table 4).

**Table 3.** Demographic and nutritional status of the study children. Elka. 1996.

Characteristic	N=(111)	%
Age		
12 - 23	53	47.7
24 - 35	35	31.5
36 - 42	23	20.7
Sex		
Male	53	47.7
Female	58	52.3
Birth order		
1st	14	12.6
2nd	16	14.4
3rd	14	12.6
4th	17	15.3
≥ 5th	50	45.0
Breast fed		
< 4 months	3	2.7
≥ 4 months	108	97.3
Age when supplementary feeding started		
4 - 6 month	27	24.3
7 - 12 month	84	75.7
WAZ		
≥ -2SD	56	50.5
< -2SD	55	49.5
HAZ		
≥ -2SD	53	47.7
< -2SD	58	52.2
WHZ		
≥ -2SD	100	90.9
< -2SD	11	9.9

### 3. Bayley mental score of children

The mean Bayley score was 88 and SD of 13. The minimum score was 50 and the maximum 114. Of the total 111 children 16 (14.4%) scored 102 (+1SD) and above, 79 (71.2%) scored 76 - 101 ( $\pm$  1SD), 12 (10.8%) scored 63 - 75 (-1 to -2SD), and 4 children (3.6%) scored less than 62 (<-2SD).

Distribution by sex showed 84.9% of males and 86.2% of females scored 76 and above. T test of mean scores between the two sexes were non significant. No correlation was found between child's age and Bayley score (Table 6).

Mean Bayley mental score by nutritional status is shown in table 7. T-test of mean Bayley score showed significant difference between stunted and non stunted children. No significant difference was observed in other anthropometric indices or with morbidity (Table 7).

**Table 6** Bayley mental score in relation to demographic and nutritional characteristic. Elka. 1996.

Variable	N=111	Bayley mental score	
		≤75 n=16 (14.4%)	≥76 n=95 (85.6%)
<b>Child age</b>			
12 - 23	53	6 (11.3%)	47 (88.7%)
24 - 35	35	8 (22.9%)	27 (77.1%)
36 - 42	23	2 (8.7%)	21 (91.3%)
<b>Child sex</b>			
Male	53	8 (15.1%)	45 (84.9%)
female	58	8 (13.8%)	50 (86.2%)
<b>WAZ</b>			
≥ -2SD	56	3 (5.4%)	53 (94.6%)
< -2SD	55	13 (23.6%)	42 (76.4%)
<b>HAZ</b>			
≥ -2SD	53	3 (5.7%)	50 (94.3%)
< -2SD	58	13 (22.4%)	45 (77.6%)
<b>WHZ</b>			
≥ -2SD	100	15 (15%)	85 (85%)
< -2SD	11	1 (9.1%)	10 (90.9%)

**Table 7.** Mean and standard deviations of Bayley score in different nutritional status. Elka. 1996.

VARIABLES	MEAN	SD	T	Sig.
<b>Child sex</b>				
Male	88.74	12.61	.40	0.53
Females	87.22	12.37		
<b>WAZ</b>				
≥ -2SD	89.21	10.91	1.17	0.28
< -2SD	86.65	13.83		
<b>WHZ</b>				
≥ -2SD	93.82	11.00	2.76	0.10
<- 2SD	87.30	12.48		
<b>HAZ</b>				
≥ -2SD	90.49	10.94	4.37	0.04
<- 2SD	85.62	13.36		
<b>Sick in ≤ 2 Weeks</b>				
Yes	87.05	14.57	0.34	0.56
No	88.49	11.05		
<b>Supplimentary feeding</b>				
<6 month	86.07	13.88	.085	0.372
≥ 7 month	88.55	11.98		

Mean Bayley mental score by sociodemographic characteristics of households showed significant difference in birth order, mother's parity and place of delivery. But no significant difference was observed in different family size, mother's age, mother's educational status or father's educational status (Table 8).

Birth order, family size and mothers parity were found to correlate positively with Bayley score ( $r=.29$  at  $p<.005$ ,  $r=.21$  at  $p<0.05$ ,  $r=.27$  at  $p<.005$  respectively). There was no significant correlation with parental age and educational status, and no correlation was observed with socioeconomic status of the family. Birth order was found to correlate with maternal age ( $r=.63$ ,  $p<.001$ ) and with family size ( $r=.66$ ,  $p<.001$ ).

**Table 8** Mean and standard deviation of Bayley score in different sociodemographic status of the households. Elka. 1996.

Variable	N=111	Mean	SD	F	Sig.F
<b>Family size</b>					
1-5	63	87.08	12.80	0.704	0.403
≥6	48	89.08			
<b>Mother's parity</b>					
1	10	79.30	13.25	3.003	0.054
2-4	46	87.85	11.76		
≥5	55	89.60	12.44		
<b>Mother's age</b>					
≤20	17	87.76	11.52	0.722	0.488
21-30	46	86.70	13.27		
≥31	47	89.74	11.60		
<b>Mother's education</b>					
Illiterate	101	88.08	12.50	0.127	0.723
Write & read	10	86.60	12.47		
<b>Mother's ANC attendance</b>					
Yes	52	86.31	13.01	1.704	0.194
No	59	89.39	11.86		
<b>Delivery place</b>					
Health institution	11	73.20	15.93	7.796	0.006
Home	100	88.64	11.91		
<b>Birth order</b>					
1st	14	82.79	12.50	2.79	0.09
2nd & above	97	88.69	12.33		
<b>Father's education</b>					
Illiterate	56	89.70	12.52	1.93	7.149
Write & read	42	87.76	10.82		
Formal education	12	82.08	15.50		

Correlation between anthropometric indices and Bayley mental score showed only HAZ to be significantly correlated with Bayley score ( $r = .25$ ,  $P < .005$ ) (Table 9).

Correlation between different anthropometric indices showed HAZ to be strongly correlated with WAZ ( $r = .63$ ,  $p < 0.001$ ), with child arm circumference ( $r = .40$ ,  $p < .001$ ) and child head circumference ( $r = .37$ ,  $P < .001$ ) (Table 10).

To minimize effect of multicollinearity only HAZ, which showed to have strong correlation with Bayley score, was taken for multiple linear regression analysis. The child's Bayley score was the dependent measure used in multiple regression analysis.

To determine which set of variables best predict Bayley score at 12-42 months of age, a stepwise multiple regression was calculated. Three variables contributed to 16% of the variance, in order of entry these three variables were: birth order, place of delivery and HAZ. Birth order shared 48.3% of the variance, place of delivery shared 29.7% of the variance and HAZ shared 22.1% of the variance (Table 11).

**Table 9** Correlations of anthropometric measurements and Bayley mental score with their correlation coefficients and 2 tailed significance.

	HAZ	WAZ	WHZ	HC	AC
Bayley Mental score	.25 (p=.007)	.10 (p=.302)	-.06 (p=.540)	.04 (p=.687)	.02 (p=.804)

**Table 10** Correlations of HAZ with other anthropometric indices and their correlation coefficient and 2 tailed significance.

	WAZ	WHZ	HC	AC
HAZ	.63 (P=.000)	.06 (P=.545)	.38 (P=.000)	.40 (P=.000)

**Table 11** Multiple regression predictors of Bayley mental score and their Beta weight. Elka. 1996.

Variables	Beta	T	Sig.T
Child age	-0.1306	-1.45	0.15
Child sex	-0.0921	-1.03	0.31
Age when Supplementary feeding started	0.1563	1.74	0.08
Birth order	0.2338	2.58	0.01
Delivery place /health institution	-0.2084	-2.29	0.02
HAZ	0.1908	2.13	0.03
Family size	0.0039	0.03	0.97
Number of children < 5 Yr	0.0989	1.09	0.28
Number of adult family members	0.0169	0.18	0.86
Parity	-0.2041	-0.52	0.61
Mother's education	0.0063	0.07	0.94
Father's education	-0.0802	-0.88	0.38
Mother age	-0.1384	-1.23	0.22
V.poor knowledg	-0.0812	-0.90	0.37
Poor knowledg	0.0075	0.08	0.93
Fair knowledg	0.0381	0.41	0.68
R <sup>2</sup> =.16449      F= 6.03      Sign F= .0003			

Relative importance of predictor variables.

Variable	R <sup>2</sup>	R <sup>2</sup> change	% change
<b>Birth order</b>	0.0795	0.0795	48.3
<b>Place of delivery</b>	0.12849	0.04899	29.78
<b>HAZ</b>	0.16449	0.03641	22.14

## Discussion

In this study under weight was found in 49.5% of children and stunting was found in 52.2% of the children. The prevalence of underweight and wasting were in agreement with the national studies (19). But the prevalence of stunting was lower than the national figure. In all three anthropometric indices, males were more affected than females which is similar to the national study. Unlike the national situation, the age group which were most affected by underweight and stunting were 24 - 35 months, similar pattern was observed in other parts of the country (N.Omo, W.Shoa, N.Gondar, Illubabor, Sidamo) in 1992 survey. Breast feeding was found to be universal and supplementary feeding was started after 7 months of infancy in 74.8% of children. Delayed initiation of supplementary feeding was observed which is also the same in other parts of the country (19).

Most of the children tested scored between 76 - 101. Significant difference was observed in mean Bayley score of children who were below -2SD HAZ and those above -2SD. The multiple linear regression analysis results also supported this finding. Unlike the Kenyan study (40), this study supports findings that H/A and mental development are positively related as shown in other studies (41,42,51). But no significant relation

was observed with other anthropometric measures unlike other studies (43,55).

Multiple regression analysis indicated that although Bayley mental score and nutritional status have significant relationship, it is not very strong, as stunting contributed to 4% of the total variance. This finding suggests that although the two variables are related with each other, it is very difficult to predict the mental development score of children even if their nutritional status is known, as the variance explained in mental score is very small. This could be because of the home environment which may provide good social stimulation, which in other study showed to be the most important variable predicting intelligence as compared to nutritional status and family variable (49).

Males and females were not different in mean Bayley score as seen in a Kenyan study (40).

Other studies have shown that socioeconomic and Parental educational status are strongly associated with mental score (46). Our result showed that performance in Bayley score was independent of economic status, family size, mother's education, father's education and mother's knowledge on child development.

This might be because, the population did not vary with regard to various environmental factors studied, had narrow socioeconomic range and similar parental stimulation and home environment.

Birth order and place of delivery are the other important predictor variables ,other than HAZ. Unlike the study done in India which showed negative relation (50), birth order showed to have positive relation to mental score. This could be because of its correlation with family size, which may provide social stimulation and mother child rearing practice.

Place of delivery shares 5% of the total variance. Delivery in health institution was found to have negative relation with Bayley score. It was also found that, all mothers who delivered in health institutions had prolonged labour for which they were taken to health institutions. This could be the reason for low score observed in those who were delivered in health institution as delivery events are some of the factors which deleteriously affect mental development (25).

#### **Limitations of this study**

Determinant factors were not exhaustive. Family style of care giving, home rearing practice which were found to be the most important variables in predicting

As most of the questions were closed ended, simple to comprehend and collected by trained interviewers who were continuously supervised and cross checked, possible introduction of inter-observer and intra-observer biases were minimized during interview. Most measurements in Bayley scale were scored in an objective and straight forward manner which maximized consistency of scoring between examiners.

All anthropometric measurements were taken by a single person to avoid inter-observer variation and equipments were checked and adjusted regularly. Exact age of each child was obtained from BHNS data.

#### **Generalizability**

It will be very difficult to generalize the findings of this study to the country because of the culture and ethnic diversity.

### **Conclusion and recommendation**

This study demonstrated high prevalence of malnutrition particularly the chronic malnutrition. And this was shown to relate to mental development. Malnutrition and environment were found to be synergistically contributing to poor development of children. Other than nutrition, birth order is the factor which was shown to have positive relation with mental development. The other factor which was shown to relate to mental development score was the birth event.

### **Recommendation**

- Extensive health education services to the rural population on nutrition, with emphasis on the time of introduction of supplementary feeding.
- Expansion of delivery services to the rural community.
- Further research on mental development of children with emphasis on the effect of family interaction and child rearing practice on mental development.

- D G D, Matthews TS. editors. Blackwell scientific publication. Oxford. 1991:68-89.
10. Williams S R. Nutrition and diet therapy. Third edition. The C.V. Mosby company. St. Louis 1977:390-417.
  11. Jelliffe D B, Jelliffe E F P. Community nutritional assessment. New York. Oxford University press. 1988:1-3.
  12. Bucht B, Karel D.F. Child mortality in developing countries. In: health care of women and children in developing countries. Oakland, California. Third world publishing comp. 1990: 279-291.
  13. Poskitt E M E. Nutrition in childhood. In: Paediatrics in the tropics. Hendricse R G, Barr D G D, Matthews TS. editors. Blackwell scientific publications. Oxford. 1991: 90-118.
  14. WHO. Diet nutrition and prevalence of chronic diseases. Technical report series 797.
  15. Gerien N. Is growth monitoring worthwhile? Health policy and planning. 1988;3(3): 181-194.
  16. Jelliffe D B. Infant nutrition in the subtropics and tropics. WHO monograph series 797.
  17. WHO. Technical report series. 667
  18. Maine D, Allman J. The demography of maternal and child health in developing countries. In: Health care of women and children in developing countries. Wallace H M, Giri K editors. Oakland, California. Third world publishing comp. 1990: 26-

- Paediatrica Scandenevica. 1974;63:687-694.
36. Evans D E, Moodie A D, Hansen J D L. Kwashiorkor and intellectual development. South African medical journal.1971;45:1413.
  37. Liang P H, Hie T T. Evaluation of mental development in relation to early malnutrition. American journal of clinical nutrition.1967;20:1290.
  38. Champakam S, Srikantia S G, Gopalan.C. Kwashiorkor and mental development. American Journal of clinical nutrition. 1968;21(8): 844-852.
  39. Nwuga U C B. Effect of sever Kwashiorkor on intellectual development among Nigerian children. American journal of Clin. Nut.1977;30:1423-1430.
  40. Sigman M, McDonald M A, Newmann C, Bwibo N. Prediction of cognitive competence in Kenyan chidden from toddlers nutrition, family characteristic and abilities. Journal of child psychology. 1991;32(2):307-320.
  41. Upadhyay S K, Agarwal D K, Agarwal K N. Influence of malnutrition on intellectual development. Indian journal of Med. Res. 1989;90:430-441.
  42. Neumann C, McDonald M A, Sigman M, Bwibo N, Marquardt M. Relationship between morbidity and development in mildly to moderatly malnourished Kenyan toddlers. Paediatrics.1991;88(5):934-942.
  43. Sigman M, Neumann C, Jansen A A J, Bwibo N.

- Cognitive abilities of Kenyan children in relation to nutrition, family characteristic and education. *Child development* 1989;60:1463-1474.
44. Aboud F E, Alemu T. Nutrition, maternal responsiveness and mental development of Ethiopian children. *Soc. Sci. Med.* 1995;41(5):725-732.
45. McDonald M A, Sigman M, Espinosa M P, Neumann C G. Impact of a temporary food shortage on children and their mothers. *Child development*.1994;65:404-415.
46. McGregore S M G. The effect of malnutrition on mental development. In: Waterlow J C editors. *Protien energy malnutrition*. Edward Arnold. London. 1992: 344-360.
47. Graves P L. Nutrition and infant behaviour: a replication study in the Katmandu Valley, Nepal. *American journal of clinical nutrition* 1978;31:541-551.
48. Bedi K S, Bhide P G. Effect of environmental diversity on brain morphology. In: Jones D G editors. *Current topics in research on synapses*. A.R.Liss. New York. 1988.
49. Powel C A, McGregor G, Gregor S. The ecology of nutritional status and development in young children. Kingston, Jamaica. *American Journal of clinical nutrition*.1985;41:1322-1331.
50. Agarwal D K, Awashthy A, Upadhyay S K, Singh P,

- Kumar J, Agrawal K N. Growth, behaviour, development and intelligence in rural children between 1-3 years of life. Indian paediatrics.1992;29:467-480.
51. Upadhyay S K, Sara A, Agarwal D K, Singh M P. Agarwal K N. Growth and behaviour development in rural infants in relation to malnutrition and environment. Indian paediatrics. 1992;29:595-606.
52. Agarwal D K, Upadhyay S K and Agarwal K N. Influence of malnutrition on cognitive development assessed by Piagetian tasks. Acta Paediatrica.scand. 1989;78:115-122.
53. Bayley N. Manual for the Bayley scales of infant development. Second edition. Psychology corporation, San Antonio, 1993.
54. Sigman M, Neumann C, Baksh M, Bwibo N, Mc Donald M A. Relationship between nutrition and development in Kenyan toddlers. The journal of Paediatrics 1989;115-357
55. Tesfaye F. Health profile and action plan of Adamitulu Woreda. DCH. AAU. 1995.
56. Lindtjorn B, Alemu T, Bjorvant B. Population growth , fertility, mortality and migration in drought prone areas in Ethiopia. In: Lindtjorn B editor. Child health and nutrition. Bergen: Norway.1991.
57. WHO Working group. Use and interpretation of anthropometric indicators of nutritional status.

WHO Bulletin.1986;64:929-941.

58. Jordan M D. CASP version 3.1. Anthropometric software package. Tutorial guide and hand book. Atlanta: The centers for disease ciontrol;1988.
59. Norusis M J. SPSS/PC + 4.0 Base manual. Chicago:SPSS Inc;1989.

**APPENDIX 1****Methods of anthropometric measurements**

A. Length/ Height (Cm). Crown heel length was measured using calibrated standard wooden boards for children less than 2 years of age, and standing Height without shoes was measured by calibrated anthropometric steel rod with head piece for children more than two years old and mothers. And the measurements were recorded to the nearest 0.1 Cm. Grades of nutrition will be assessed using NCHS/ WHO data.

B. Body weight (Kg). Weight of a child was taken with minimal clothing using salter type spring hanging scale which is 25x100gm, calibrated and rounded off to the nearest 100 gm. Weight of the mothers were taken using salter scale recorded to the nearest 100 gm.

C. Mid upper arm circumference. This was taken at mid point between the acromion and olecranon process of left arm while hanging freely using metric tape without compressing the skin. And the circumference is recorded to the nearest 0.1 Cm.

D. Head circumference (Cm). This was measured with measuring tape encircling the occipital protuberance on the back of the head and glabella in front. And it was recorded to the nearest 0.1 Cm.

**APPENDIX 2** AN ENGLISH VERSION OF THE QUESTIONNAIRE

Date.....

Place.....

PART 1. GENERAL INFORMATION

1. Peasant association..... House Number....
2. Family size.....  
Adult=.... children(<15)=.... Under=.....
3. Head of the household
  1. Father
  2. Mother
  3. Other, specify\_\_\_\_\_

PART 2I. Basic information on family or care-taker

1. Is the child's mother alive? Yes\_\_\_\_ No\_\_\_\_  
If yes, what is her age? \_\_\_\_\_  
Where is she living?\_\_\_\_\_
2. Is the child's father alive? Yes\_\_\_\_ NO\_\_\_\_  
If yes, what is his age?\_\_\_\_\_  
Where is he living?\_\_\_\_\_
3. What is the number of children born alive?\_\_\_\_\_
4. Marital status of parents of the child
  1. Single/ unmarried
  2. Married/ together
  3. Divorced
  4. Widowed
5. Religion of head of the household
  1. Christian
  2. Muslim
  3. Other/ specify\_\_\_\_\_
6. Language spoken in the family
  1. Oromigna
  2. Amharigna
  3. Guragigna
  4. Other/ specify\_\_\_\_\_
7. Ethnicity of parents/ care takers
  1. Oromo
  2. Amhara
  3. Guragae
  4. Other/ specify
8. Mothers educational status
  1. Illiterate/neither read nor write
  2. Read and write
  3. Elementary school complete
  4. Junior high school
  5. Senior high school

6 12th grade complete

9. Occupation of the mother

1. House wife
2. Civil servant
3. Commercial - small shop owner\_\_\_\_  
- open market\_\_\_\_  
- bar tender\_\_\_\_
4. Other/ specify\_\_\_\_\_

10. Fathers educational status

1. Illiterate/ neither read nor write
2. Read and write
3. Elementary school complete
4. Junior high school
5. Senior high school
6. 12th grade complete

11. Occupation of the father

- |                  |                        |
|------------------|------------------------|
| 1. Civil servant | 5. pensioned           |
| 2. Farmer        | 6. Unemployed          |
| 3. Trader        | 7. Other, specify_____ |
| 4. fisher man    |                        |

12. Housing type

- |             |                           |
|-------------|---------------------------|
| 1. Thatched | 2. Corrugated iron roofed |
|-------------|---------------------------|

13. What is the approximate monthly income of the family?

1. Less than 50 Birr
2. 51 - 100 Birr
3. 101 - 200 Birr
4. 201 - 500 Birr
5. > 500 Birr

14. Does the family own cattle? yes\_\_\_\_ no\_\_\_\_

- If yes, how many?
1. 1-5
  2. 6-10
  3. 11-15
  4. >15

15. Does the family own sheep? yes\_\_\_\_ no\_\_\_\_

- If yes, how many?
1. 1-5
  2. 6-10
  3. 11-15
  4. >15

16. Does the family own goats? yes\_\_\_\_ no\_\_\_\_

- If yes, how many?
1. 1-5
  2. 6-10
  3. 11-15
  5. >15

17. Does the family own chicken? yes\_\_\_\_ no\_\_\_\_  
 If yes, how many? 1. 1-5  
 2. 6-10  
 3. 11-15  
 4. >15

18. Does the family own farm plot? yes\_\_\_\_ no\_\_\_\_

19. Do all family members eat together? yes\_\_\_\_ no\_\_\_\_  
 If not, who is served first? 1. father  
 2. mother  
 3. children  
 From the children, who is served first?  
 1. male children  
 2. female children

Whom does the family food distribution favours?

Age 1. children\_\_\_\_ 2. Adult\_\_\_\_  
 3.No difference\_\_\_\_  
Sex 1. Male\_\_\_\_ 2. Female\_\_\_\_  
 3.No difference\_\_\_\_

## II. Information on index child

1. Age of the child \_\_\_\_\_ months
2. Sex of the child 1. Male 2. Female
3. Birth order of the child \_\_\_\_\_
4. Did the mother attend ante natal care while pregnant? Yes\_\_ No\_\_
5. Where is the child delivered?  
 1. Home 2. Health institution 3. Other, specify\_\_
6. Was the delivery uneventful  
 1. Yes\_\_\_\_ 2. No\_\_\_\_  
 If no, what was the problem?\_\_\_\_\_
7. For how long has the child been breast fed  
 1. < 4 month 3. 1 - 2 years 5. Still feeding  
 2. < 1 year 4. > 2 years
8. At what age did you start him on supplementary feeding? \_\_M
9. Was the child vaccinated?  
 1. Yes 2. No  
 If yes, for how long?\_\_\_\_\_ (see the card)
10. Was this child ill in the past two weeks?  
 1. Yes 2. No 3. Do not remember

11. If the child was sick, do you know the type of illness?

1. Yes                      2. No

12. If yes, what was the illness

	Yes	NO
1. Diarrhea	___	___
2. Vomiting	___	___
3. Fever	___	___
4. Skin rash	___	___
5. Eye infection	___	___
6. running nose	___	___
7. Difficult to swallow	___	___
8. refuse to feed	___	___
9. Hoarseness of voice	___	___
10. cough	___	___
11. Difficulty or fast breathing	___	___
13. Ear discharge	___	___
14. Ear pain	___	___
15. Other symptoms _____	___	___

13. What was done to the child during the illness?

1. Taken to health institution
2. Assisted by traditional healer
3. Given home care only
4. nothing was done

III. Mothers knowledge about child development

1. At what age does a child identify who its mother is? \_\_\_\_\_
2. At what age does a child start to understand word spoken? \_\_\_\_\_
3. At what age does a child start to communicate using sound/ words? \_\_\_\_\_
4. At What age does a child start to remember? \_\_\_\_\_

PART 3 ANTHROPOMETRY

- CHILD
1. Weight in KG (to the nearest 0.5 gm) \_\_\_\_\_
  2. Height in Cm (to the nearest 1 Cm ) \_\_\_\_\_
  3. Head circumference in Cm ( >> >> ) \_\_\_\_\_
  4. Arm circumference in cm ( >> >> ) \_\_\_\_\_
- Mother
1. Weight
  2. Height
  3. BMI (W/H2) = \_\_\_\_\_ Pregnant Y \_\_\_ N \_\_\_

MEASURES TAKEN

- Health advice \_\_\_\_\_  
 Referral given \_\_\_\_\_  
 Treatment given \_\_\_\_\_

AMHARIC VERSION OF THE QUESTIONNAIRE

APPENDIX 3.

ቀን \_\_\_\_\_

ክፍል 1. አጠቃላይ መረጃ

1. የገበሬ ማህበር \_\_\_\_\_ የቤት ቁጥር \_\_\_\_\_
2. የቤተሠብ ብዛት \_\_\_\_\_
  1. 1-11 ወር \_\_\_\_\_
  2. 1-4 ዓመት \_\_\_\_\_
  3. 5-10 ዓመት \_\_\_\_\_
  4. 11-17 ዓመት \_\_\_\_\_
  5. ከ 17 ዓመት በላይ \_\_\_\_\_
3. የቤተሰብ አስተዳዳሪ ማነው 1. አባት 2. እናት 3. ሌላ \_\_\_\_\_

ክፍል 2.

I. ቤተሰቡን የተመለከተ መረጃ

1. የልጅ እናት በህይወት አሉ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
አዎ ከሆነ መልሱ እድሜያቸው ስንት ነው? \_\_\_\_\_  
የሚኖሩትስ የት ነው? \_\_\_\_\_
2. የልጅ አባት በህይወት አሉ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
አዎ ከሆነ መልሱ እድሜያቸው ስንት ነው? \_\_\_\_\_  
የሚኖሩትስ የት ነው? \_\_\_\_\_
3. በአጠቃላይ በህይወት የተወለዱ ልጆች ቁጥር ስንት ይሆናል? \_\_\_\_\_
4. የወላጆች የጋብቻ ሁኔታ
  1. ያላገቡ
  2. ተጋብተው አብረው የሚኖሩ
  3. የተፋቱ
  4. በጥጥ የተለያዩ
5. የቤቱ አስተዳዳሪ ሃይማኖት 1. ክርስቲያን  
2. እስላም  
3. ሌላ \_\_\_\_\_

6. ቤተሰቡ የሚጠቀምበት ቋንቋ  
 1. አሮምኛ 2. አማርኛ 3. ጉራጊኛ 4. ከምባትኛ  
 5. ማረቆኛ 6. ሌላ \_\_\_\_\_
7. የቤቱ አስተዳዳሪ ብሔረሰብ  
 1. አሮሞ 2. አማራ 3. ጉራጊ 4. ከምባታ  
 5. ማረቆ 6. ሌላ \_\_\_\_\_
8. የእናት የትምህርት ደረጃ  
 1. መፃፍና ማንበብ የማይችሉ  
 2. መፃፍና ማንበብ የሚችሉ  
 3. 1ኛ ደረጃ ትምህርት ያጠናቀቁ  
 4. መለስተኛ 2ኛ ደረጃ ትምህርት የደረሱ  
 5. 2ኛ ደረጃ ትምህርት የደረሱ  
 6. 12ኛ ክፍል የጨረሱ
9. የእናት የሥራ ሁኔታ  
 1. የቤት እመቤት 2. የመንግሥት ሠራተኛ  
 3. የግል ንግድ ሥራ - አነስተኛ ሰቅ  
 - የጉልት ንግድ  
 - ሌላ ንግድ \_\_\_\_\_  
 4. የቀን ሥራ 5. ሌላ \_\_\_\_\_
10. የአባት የትምህርት ደረጃ  
 1. መፃፍና ማንበብ የማይችሉ  
 2. መፃፍና ማንበብ የሚችሉ  
 3. 1ኛ ደረጃ ትምህርት ያጠናቀቁ  
 4. መለስተኛ 2ኛ ደረጃ ትምህርት የደረሱ  
 5. 2ኛ ደረጃ ትምህርት የደረሱ  
 6. 12ኛ ክፍል የጨረሱ
11. የአባት የሥራ ሁኔታ  
 1. የመንግሥት ሠራተኛ 5. ጡረተኛ  
 2. ገበሬ 6. ሥራ የሌላቸው  
 3. ነጋዴ 7. ሌላ \_\_\_\_\_  
 4. አሳ አጥማጅ
12. የመኖሪያ ቤት አይነት 1. የሣር ቤት  
 2. የቆርቆሮ ቤት
13. የቀንድ ከብቶች አላችሁን ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
 ካለ ምን ያህል ? 1. ከ 1-5 2. ከ 6-10  
 3. ከ 11-15 4. ከ 15 በላይ ፣ ግለፅ \_\_\_\_\_

14. በጎች አላችሁን ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
 ካላችሁ ምን ያህል ናቸው ? 1. ከ 1-5  
 2. ከ 6-10  
 3. ከ 11-15  
 4. ከ 15 በላይ ፣ ግለፅ \_\_\_\_\_

15. ፍየሎች አላችሁን ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
 ካላችሁ ምን ያህል ናቸው ? 1. ከ 1-5  
 2. ከ 6-10  
 3. ከ 11-15  
 4. ከ 15 በላይ ፣ ግለፅ \_\_\_\_\_

16. ዶሮዎች አላችሁን ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
 ካላችሁ ምን ያህል ናቸው ? 1. ከ 1-5  
 2. ከ 6-10  
 3. ከ 11-15  
 4. ከ 15 በላይ ፣ ግለፅ \_\_\_\_\_

17. የእርሻ መሬት አላችሁ ? አዎ \_\_\_\_\_ የለም \_\_\_\_\_

18. የቤተሰቡ አባላት በሙሉ አንድ ላይ ነው ምግብ የሚመገቡት ?  
 አዎ \_\_\_\_\_ የለም \_\_\_\_\_  
 ካልሆነ መጀመሪያ የሚመገበው ማነው ?  
 1. አባት 2. እናት 3. ልጆች  
 ለምን ? \_\_\_\_\_  
 ከልጆች መካከል መጀመሪያ የሚመገበው ማነው ?  
 1. ወንድ ልጆች 2. ሴት ልጆች  
 ለምን ? \_\_\_\_\_

19. በቤተሰብ ምግብ ክፍፍል ውስጥ ልዩ ትኩረት የሚያገኘው ማን ነው ?  
በዕድሜ 1. ልጆች 2. አዋቂዎች 3. ልዩነት የለም  
በጾታ 1. ወንዶች 2. ሴቶች 3. ልዩነት የለም

II. ልጁን የተመለከተ መረጃ

1. የልጁ ዕድሜ ስንት ነው ? \_\_\_\_\_ ወር

2. የልጁ ስታ ምንድን ነው ? 1. ወንድ \_\_\_\_\_ 2. ሴት \_\_\_\_\_
3. ልጁ ስንተኛ ልጅዎ ነው ? \_\_\_\_\_
4. ልጁን ነፍስ ጡር ሆነው እናቱ የቅድመ ወሊድ ክትትል ያደርጉ ነበር ?  
1. አዎ \_\_\_\_\_ 2. የለም \_\_\_\_\_
5. ልጁ የተወለደው የት ነው ?  
1. በቤት ውስጥ  
2. በጤና ተቋም  
3. ሌላ ግለፅ \_\_\_\_\_
6. ልጁን የተገላገሉት በስንተኛ ወር እርግዝና ነው ? \_\_\_\_\_
7. ልጁን ያለ ምንም ችግር ነበር የተገላገሉት ? 1. አዎ \_\_\_\_\_ 2. የለም \_\_\_\_\_  
ችግር ክነበረ ምን ዓይነት ችግር እንደ ነበር ቢገለፅ \_\_\_\_\_
8. ልጁ ለምን ያህል ጊዜ ነው ጡት የጠባው ?  
1. ከ4 ወር በታች  
2. እስከ 1 ዓመት ድረስ  
3. እስከ 2 ዓመት ድረስ  
4. ከ 2 ዓመት በላይ  
5. አሁን በመጥባት ላይ ነው
9. ልጁ ተከትሏል ? 1. አዎ \_\_\_\_\_ 2. የለም \_\_\_\_\_  
ከተከተበ ለምን ያህል ጊዜ ነው የተከተበው ? \_\_\_\_\_  
ካርዱን ተመልከት
10. ልጁ ባለፉት 2 ሳምንታት ውስጥ ታሞ ነበር ?  
1. አዎ \_\_\_\_\_ 2. የለም \_\_\_\_\_ 3. አላስታውስም \_\_\_\_\_
11. ታሞ ክነበረ በሽታው ምን እንደነበረ ያውቃሉ ?  
1. አዎ \_\_\_\_\_ 2. የለም \_\_\_\_\_
12. የሚያውቁ ክሆነ በሽታው ምን ነበር ?

	<u>አዎ</u>	<u>የለም</u>
1. ተቅማጥ	_____	_____
2. ትውከት	_____	_____
3. ትኩሳት	_____	_____
4. የቆዳ ሽፍታ	_____	_____
5. የአይን ህመም	_____	_____
6. የአፍንጫ መዝረክረክ	_____	_____
7. የመዋጥ ችግር	_____	_____
8. የምግብ ፍላጎት ማጣት	_____	_____
9. የድምፅ መዘጋት	_____	_____
10. ሳል	_____	_____

APPENDIX 4                      ANSWER SHEET                      DATE-----

NAME-----                      SEX-----                      DATE OF BIRTH-----

AGE IN MONTH-----                      TESTER-----                      RECORDER-----

(√) for right                      (x) for wrong

---

8m→	59---		101---		143---
	60---		102---		144---
	61---		103---		145---
9m→	62---		104---	38-42→	146---
	63---		105-- *13M		147---
10→	64---		106---		148---*23-25M
	65---	20-22→	107---		149---
11→	66---		108---		150---
	67---		109---		151---
	68---		110---		152---
	69---		111---*14-16M		153---
	70---		112---		154---*26-28M
12→	71---	23-25→	113---		155---
	72---		114---		156---
	73---		115---		157---
	74---		116---		158---*29-31M
	75---		117---		159---
	76---		118---		160---
	77---		119---		161---
13→	78---		120---		162---
	79---		121---		163---
	80---		122---		164---
	81---	26-28→	123---		165---
	82---*8M		124---		166---*32-34M
	83---		125---		167---
	84---		126---		168---*35-37M
	85---		127---*17-19M		169---
	86---*9M		128---		170---
14-16→	87---*10M		129---		171---
	88---		130---		172---
	89---	29-31→	131---		173---
	90---		132---		174---
	91---		133---		175---
	92---*11M		134---		176---
	93---		135---*20-22M		177---
	94---	32-34→	136---		178---*38-42M
	95---		137---		
	96---		138---		
17-19→	97---		139---		TOTAL SCORE=-----
	98---	35-37→	140---		
	99---		141---		
	100---*12M		142---		

To be filled by the principal investigator.

INDEX SCORE-----