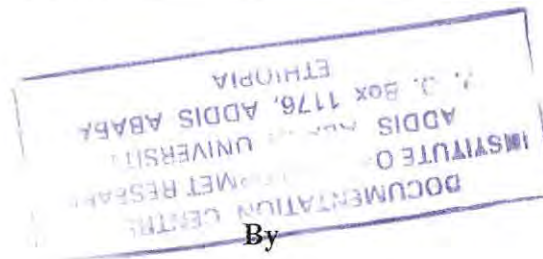


**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**

**DETERMINANTS OF THE NUTRITIONAL STATUS OF CHILDREN IN  
AMHARA REGION: The case of Misrak Gojjam and Semen Wello Zones**

*A Thesis Presented to the School of Graduate Studies  
Addis Ababa University  
In Partial Fulfillment of the  
Requirements for the  
Degree of Master of Science in Demography*



By

**Aschalew Gemechu**

May, 2000

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By  
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## DEDICATION

Dedicated to my wife, Mekides  
for  
her encouragement, temperance and love.

## ABBREVIATIONS

ACC/SCN	Administrative Coordinating Committee Sub-Committee on nutrition of the United Nations
CDS	Center for Diseases Control
CSA	Central Statistical Authority
DHS	Demographic and Health Survey
DPPC	Disaster Prevention and Preparedness Commission
DTRC	Demographic Training and Research Center
EA	Enumeration Areas
FAO	Food and Agricultural Organization
GDHS	Ghana Demographic and Health Survey
HHR	Height Heaping Ratio
KDHS	Kenya Demographic and Health Survey
MEDAC	Ministry of Economic Development and Cooperation
NCHS	National Center for Health Statistics
SD	Standard Deviations
SPSS	Statistical Package for Social Science
UDHS	Uganda Demographic and Health Survey
UN	United Nations
UNICEF	United Nation's Children's Fund
WHO	World Health Organization
WHR	Weight Heaping Ratio

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## **ABSTRACT**

*Child malnutrition has been a serious and widespread problem of Semen Wello and Misrak Gojjam Zones. Using data from 1998 Health, Nutrition and Welfare monitoring survey conducted by Central Statistical Authority (CSA), this study estimates the levels of child malnutrition and identifies the different factors associated with chronic malnutrition among children in Misrak Gojjam and Semen Wello Zones of Amhara region. A total of 457 children from Misrak Gojjam and 549 from Semen Wello Zones aged 3-59 months were included in this study. Both descriptive and inferential techniques were used to analyze the data. The univariate analysis is used to see the percentage share of background variables while the bivariate and multivariate analysis were employed to examine the differentials and risk factors of malnutrition. The findings indicate the level of malnutrition is very high in each Zones. Where 67 percent, 8.9 percent and 58.3 percent of children in Misrak Gojjam Zone were stunted, wasted and underweight, respectively, while in Semen Wello Zone 68.9 percent, 9.0 percent and 57.5 percent of children are stunted, wasted and underweight, respectively.*

*The bivariate analysis using chi-square test showed the existence of association between explanatory variables and chronic malnutrition. The multivariate results using logistic regression revealed that all the socioeconomic, demographic, child care and environmental factors are responsible in affecting chronic malnutrition both in Misrak Gojjam and Semen Wello Zones.*

*Finally, improvement in household incomes and access to food for the poor, education in appropriate feeding practices and also expansion of family planning programs for spacing and limiting the number of children are among the recommendations of the study.*

# CHAPTER ONE

## 1. INTRODUCTION

### 1.1. Background

Mortality and morbidity are two serious existing problems of the world, particularly for developing countries. Although it is estimated that infant and child mortality has started declining consistently in all developing countries since 1970, the level is still high for these countries when compared with the developed countries. For instance, in 1990-1995, about 11 million children died annually before reaching age 5 and 8.2 million of them did not reach their first birth day. The vast majority of those deaths (98 percent) occurred in developing countries. In the developed world, during 1990-1995 only 11 out of every 1,000 newborn children died before they attained age 1; in the developing world, the equivalent number of deaths was 68 per 1,000 newborns.

Similarly, mortality under age 5 was 7 times higher in developing countries than in developed countries. Infant and child mortality are frequently regarded as indices reflecting the degree of poverty and deprivation of a population. The major causes for the high level of mortality in the developing countries are disease and malnutrition (UN, 1998). The need for food is second only to the need for air and water. Nutrients are required for survival, for growth and reproduction, and for capacity to work, to learn, and to function in society.

*Undernutrition is related to inadequate quantities of food and hence to inadequate intake of calories or food energy. Malnutrition is, on the other hand, the pathological condition brought about by inadequacy of one or more nutrients.*

*Undernutrition and malnutrition are intertwined and undernourished children are*

*malnourished in almost all cases. Malnourishment is the term popularly applied to all nutrient deficiencies (Berg, 1999).*

Inadequate nutrition or malnutrition is one of the most important health and welfare problems among infants and young children in developing countries. Generally, the basic cause of malnutrition in developing countries are socioeconomic. Poverty is pervasive in much of the Third World, and the capacity of families to purchase and/or produce food is limited (H.Mosley, and C. Chen, 1994). Malnutrition is a direct result of both inadequate food and infectious diseases. Inadequate food intake is a consequence of insufficient food at the household level and improper feeding practices. Infectious diseases, particularly diarrhea, acute respiratory illness, malaria and measles, result from inadequate health care, an insufficient water supply and poor environmental sanitation. Poor sanitation puts infants and young children at risk of increased incidence and duration of illness (African nutrition, 1993).

Diarrhea disease compromises nutritional status through reduced dietary intake, poor absorption and increased nutrient loss. In environments where infectious diseases are common, children typically suffer recurrent infections and are unable to recover fully from each bout of illness. The result is weakened immunity and increased susceptibility to malnutrition when both malnutrition and infection are present the result is an interaction that is biologically more detrimental than the combined effect the two working independently (Scrim Show et al., 1968). Both inadequate food intake and prevalence of disease reflect underlying social and economic conditions, at the household, community and national level (Rutstein, 1996).

Undernutrition has a significant health and economic consequences, among which is increased risk of death illness, lower cognitive development and poor pregnancy outcome. It is also responsible for human and economic waste of consequential proportions. A number of studies carried out in the United States of America and Latin America during the 1960s and 1970s concluded that children with histories of malnutrition did more poorly on intelligence tests than children of identical socioeconomic backgrounds who had been properly nourished (Barry R. 1999). Malnutrition has also inter-generation effects, infants born to women who themselves were malnourished during early childhood are smaller than infants born to better nourished women (Villar and Rivera, 1988). Infants born with low birth weight (defined as less than 2.5 K.g.) are at greater risk of illness and death compared with normal weight infants (IOM, 1985).

The nutritional state of the populace both influences and reflects the level and pace of national development. The nutritional status of young children is assumed to reflect the nutritional status of the rest of the population. Young children, because of their fast rate of growth and lack of ability to fend for themselves, are particularly vulnerable to the deprivations that may affect older members of the same community to a lesser degree.

- Different studies have revealed that, children's morbidity and mortality are strongly related with malnutrition. Undernourished children are at greater risk of dying than well nourished children (Pelletier et al, 1993). More than half of child deaths that occurred in developing countries are attributed to malnourishment, especially moderate and severe malnutrition (WHO and UNICEF 1995 as cited by FAO 1996). The situation is worse in African countries, for instance in Senegal and Zambia 38 percent, in Uganda 40 percent, in Zimbabwe 28 percent

and in Kenya 38 percent of all deaths that occur before age five are related to malnutrition (Macro International Inc. 1996).

The prevalence of malnutrition in developing countries is very high where one out of every two people in these countries is malnourished. The high prevalence of malnutrition plays a part in substantial numbers of deaths, and inadequate diet and related illness interfere with the learning ability, capacity to work, behavior, and well-being of large segments of the population. Nutritional trends in most parts of Africa deteriorated during the 1980s. The number of people not taking adequate calories for an active and healthy life rose from 130 million to 170 million during the decade. This upward trend in food insecurity paves the way for future famine (Barry Riley, 1999). The magnitude of malnutrition is also increasing year after year. The number of underweight children under 5 years of age is rising, from some 164 million in 1980 to 184 million in 1990, with a projection of 200 million by the turn of the century, a major increase is expected in Sub-Saharan Africa (Anderson, 1995).

Micronutrient deficiencies are also widespread. About 14 million preschool children have eye damage as a result of vitamin A deficiency. Between a quarter and a half a million such children go blind each year from lack of vitamin A, and two third of these die within months of going blind. Iron deficiency, leading to anemia, which diminishes learning capacity as well as lowering physical health also affects about a billion people in the world particularly children (Anderson, 1995).

✓ A number of household nutrition surveys undertaken during the past 20 years demonstrate clearly that malnutrition in Ethiopia is serious and widespread. The peculiar characteristic of

malnutrition in Ethiopia is that a significant number of the victims are children (0-59 months). The most recent of these surveys reveal that all Ethiopian children who are under 5 years of age are significantly chronically malnourished, most probably from a combination of ill health and under-consumption of calories, protein and micronutrients. A high prevalence of low birth weight babies (representing, in large part, malnutrition in the womb) not only contributes additionally to the problem but is symptomatic of an even more inducing problem where mothers themselves are malnourished as they give birth to low birth weight babies who, as they grow, face the same cycle of nutrition deprivation their mothers encountered as infants. They will eventually become malnourished adults, the half of them who are mothers giving birth to yet another round of low birth weight babies and on, indefinitely (Barry R., 1999).

- The prevalence of malnutrition in the country is very high for instance, Stunting in 1983 was 59.8 percent (CSA, 1983), 64.1 percent in 1992 (CSA, 1993), 62.3 percent in 1997 (CRS, 1997) and 51.6 percent in 1998 (CSA, 1999). These high level of long term malnutrition indicates that the nutritional status of children in Ethiopia is one of the lowest in the world. The percentage of overall (general) malnutrition (underweight) is 37% in 1983 (CSA, 1983), 47 percent in 1992 (CSA, 1993) and 44.1 percent in 1998 (CSA, 1999). Though the figures fluctuate, generally they indicate the prevalence of long term or chronic and acute malnutrition that ranks the country among the highest in Sub-saharan Africa countries. For instance, the prevalence of Stunting of the country is the highest among 37 countries in 1997 followed by Mozambique and Rwanda (Barry R., 1997).

Since in Ethiopia those harmful consequences extend well beyond the individual or household level, they become major, deleterious consequences for social, cultural and economic health of

the nation as a whole. This problem of high prevalence of malnutrition has two distinct aspects: acute malnutrition resolution from drought and epidemics in some years and some geographical areas and chronic malnutrition resolution from poverty related factors occurring in all parts of the country (CSA, 1993).

However, the prevalence of malnutrition is different for different parts of the country. For instance, chronic malnutrition ranges from 49.2 percent in Semen Omo Zone to 73.6 percent in West Gojjam Zone, Wasting also ranges from 4.4 percent in Bale region to 14.2 percent in Tigray region (CSA, 1992). The prevalence is much higher in rural parts of the country than urban areas (Barry R., 1999). Stunting reaches up to 86 percent in rural parts of Tigray (Lai Gaint, Simada and TachGaint) and Amhara (South Gondar) regions (CRS, 1997). The proportion of stunted, wasted and underweight children for Misrak Gojjam and Semen Wello Zone are 68.9, 13.3, 54.1 and 68.6, 8.7 and 53.0 percent respectively. These levels are among the highest in the country (CSA, 1993).

## **1.2. Statement of The Problem**

The population of Ethiopia as of October 1994 was found to be 53.5 million of which 13.7 percent live in Urban areas and 84.3 percent live in rural areas. About 65 percent of the total population is under 25 years of age showing that the population is young. The average annual population growth rate is about 2.9 percent depicts a rapid population growth and is a very high rate when compared with most of the developing countries. Infant and under five mortality rate of the country is among the highest in the world. Per capita income remained at US \$ 100 per annum shows the country is being characterized by low level of economic development.

From the total populations in the country, 13.8 million (25.8%) live in Amhara region which makes the region the second populous next to Oromia region. The census result revealed that 9.1 percent of the total population in the region live in urban areas while the remaining 90.9 percent live in rural areas. The number of children under 5 was 2.1 million which accounted 15.2 percent from the total population in the region. The infant, child and under five mortality rates for the region are 116, 61 and 170 per thousand respectively, which are among the highest in the country. The 1992 Rural Nutrition Survey revealed that long-term (Chronic) malnutrition is very common in the region. Chronic malnutrition (stunting ) ranged from 56.7 percent in North Shewa Zone to 73.6 percent (the highest in the country) in West Gojjam Zone (CSA, 1992). The Survey also revealed that Acute malnutrition (Wasting) and General malnutrition (Underweight) are series existing problems in the region.

Semen Wello and Misrak Gojjam Zones are two of the 11 Zones of the region. Both Semen Wello and Misrak Gojjam Zones are not equally accessible in terms of modern social services like information, education, health service centers and the like. Semen Wello Zone is relatively inaccessible when compared with Misrak Gojjam Zone. Semen Wello Zone accounts 9.1 percent of the total population of the region. The census results showed that infant, child and under five child mortality are 110, 56 and 159 per thousand respectively and these mortality rates are among the highest in the country.

According to Ministry of Economic Development and Cooperation (MEDAC) and Disaster Prevention and Preparedness Commission (DPPC), Semen Wello Zone is one of the most food insecure (food deficit) Zone in the region for consecutive years. The 1992 Rural Nutrition Survey also showed that the Zone is one of the highest Stunted (68.6%) Zones in the country.

Misrak Gojjam Zone accounts 12.3 percent of the total population of the region. The census results showed that the Zone has higher mortality than that of Semen Wello, that is, infant, child and under five mortality are 112, 58 and 163 per thousand respectively. Unlike Semen Wello Zone, Misrak Gojjam Zone is one of the few food secure (food surplus) Zones in the region (MEDAC and DPPC). Nevertheless, according to the above mentioned survey, it is also one of the highest stunted (68.9%) Zones in the country. Many other surveys (like CRS, 1997; CSA, 1983) have also shown that malnutrition is a serious existing problem and its contribution for mortality of children under five years of age is significant for the two Zones.

In summary, the prevalence of malnutrition according to the previous surveys is very high in the two Zones and different reports apparently show that whether the area is food secure or not, there is no variation in the nutritional status of Children (Stunting is greater than 60 percent) in both Zones, (CSA, 1993) and also its consequences (the observed high mortality under five years of age in both Zones, CSA, 1998) is considerable. Studies on the determinants of nutritional status of children under five years of age for these Zones is not readily available and therefore a more detailed study is needed to find out the important risk factors of the problem so that decision and policy makers, planners and NGO's working on socioeconomic development in the Zones have information on the different factors and their contribution for the malnutrition of children under five years of age in the Zones which enables them to overcome the existing problems.

Therefore in view of the fact that the prevalence of stunting in both Zones is among the highest, this study tries to examine the different possible factors (determinants) and their contribution to the high prevalence of malnutrition in both the Zones. Hence it is expected that the results of this study shall be helpful to the concerned bodies in order to overcome and improve the existing problems. Besides, this critical study is vital to draw relevant policy implications for the Zones.

### **1.3. Objectives of The Study**

#### **General Objectives**

The general objective of this study is to examine the level and the various possible factors and their contribution for the current high prevalence of malnutrition using the most recent available data in Misrak Gojjam and Semen Wello Zones of Amhara region. Further, the study examines whether the same factors affecting nutritional status in each Zone also affect both Zones together or not.

#### **Specific Objectives**

1. To estimate the level of malnutrition for the two Zones.
2. To find out the relative importance of socioeconomic and demographic factors on malnutrition in the two Zones.
3. To assess the child care and environmental factors on malnutrition in the two Zones.

### **1.4. Related Literature's Review**

Different literature's are available concerning the nutritional status of children. The following literature review focuses on the Socioeconomic, Demographic, Child Care and Environmental determinants of children's nutritional status.

### *Socioeconomic Characteristics*

One of the underlying causes of malnutrition is household food security. Income is the major determinant for the accessibility of food in the household. A household with better income could provide better nutrition child care, sanitation housing etc., therefore members of the household will not be easily attacked by different types of infectious diseases. For instance, in Kenya Muranga district, the big difference in height for age (Stunting) has been observed between children from rich and poor households (Hoorweg et al, 1983 as cited by Gultineh, 1999). Choudhry, (1986) as cited in Gugsu (1997) studied about developing countries about the contribution of income for the nutritional status in a society which has different groups, the study showed a significant relationship between income and nutritional status of children.

A similar strong impact of household income on the nutritional status of children is observed in study done by Garica and Anderson, 1987. Different studies have shown that there is a negative relationship between malnutrition and the amount of land cultivated of a household in Ethiopia (CSA, 1993). In Ethiopia various studies also supported this fact. Eshetu and Ashagre (1997) used the 1992 Rural Nutritional survey which was conducted by the Central Statistical Authority to estimate the levels and identify factors associated with chronic malnutrition among children in the southern part of the country. In their analysis, they found that household income had a significant effect with chronic malnutrition (Kefene, 1999). Though generally income has a role for the nutritional status of children, if women (mothers) are not empowered with knowledge or time, for example, any increased income may not be used to maximal nutritional benefit.

Mother's education helps to create awareness about child's health condition and better sanitation for the child. Besides, encouraging changes in behavior which aims at improving the human condition, education also induces self confidence and self reliance in an individual and enables informed decision making in such areas as health and nutrition, family planning, water and sanitation and production and its management. Studies have shown that education has a measurable impact on the multiple roles of women (i.e. their productive and reproductive roles). According to Zlotkin (1991) Undernutrition can already take place during pregnancy. Therefore the role of education for mothers concerning their diet, antenatal care and the like is considerable. Mothers who are educated could provide adequate child care and alter the wrong feeding practice of the household.

There is a negative association between mother's education and child mortality (Caldwell, 1979 as cited in Girma, 1999) and mother's education and the likelihood that her children are undernourished, the higher the level of education, the lower the percentage classified as undernourished. For instance, the single greatest cause of malnutrition in Kenya is ignorance (Monicca A. Magadi, 1997) and also, in Kenya a higher significant association between maternal education and infant/child mortality was observed (Odhiambo, 1991). In Uganda underweight is almost twice as high among children of mothers with no education, and almost 20 percent higher among children of mothers with only primary school education, compared to children of mothers with secondary or higher education (UDHS, 1995). Strauss (1990), Senauer and Garica (1991) also found that educational level of parents have a significant effect on the nutritional status of children (Kefene, 1999).

Stunting consistently is most prevalent among children whose mothers received no formal schooling and least prevalent among children of mothers with secondary or higher education children whose mothers attended primary school intermediate levels of undernutrition (UDHS, 1995). A study is done by Haga and Kenrick (1985) for 22 countries showed that a positive correlation exists between the illiteracy rate among women and proportion of children who were malnourished.

Culture and food taboo are the other major causes of Undernutrition in a society. In appropriate cultural beliefs and practices often causes failures to give their children diets that are less in quantity and quality than those they could provide. H.Moslely and C. chen, 1994; Rizvi, (1983:30,35) described how girls in Bangladesh from puberty onwards learn to become the least demanding in the family and give priority to the needs of the male members of the household when food is scarce. The same phenomena was observed in Sri-Lanka. Women from southern India feed their husband first (Wandel and Hormboe, 1983). The best and the most nourishing portions of the food are served to the males.

Maletnlema, et al (1974:64) summarizes results from food in 5 villages in different regions in Tanzania and states that “ food is made by women for men and often the better share in quality and quantity is given to men”. The food needs of infants and mothers were ranked much lower in a survey conducted in Pakistan (Anwar and Ijaz, 1984). In Ethiopia, around Rift valley Lakes (Abaya and Chamo) and the River Omo, the people don't eat some types of food like fish which is very rich in its protein content because of their belief (Gugsa, 1997).

Different studies have shown that mother's opinion have an association with the performance of children growth and development. Generally, mothers who have the know-how and follow closely about children's growth performance are better to feed nutrient food items and could provide a better child care, which in turn affects positively children's nutritional status. On the other hand, even though the know-how exists, because of lack of resources for the household and the community, high prevalence of malnutrition could exist. Yohannes (1993) studied a war-torn society, in Ethiopia about the nutritional status of children. In his findings, the likelihood of undernutrition was almost 40 percent lower for those children whose mothers reported their growth performance 'Good' than to children whose performance was reported to be 'poor'.

### *Child Care and Environmental Characteristics*

The quality and quantity of water (cleaner drinking water and more water) are another underlying causes of malnutrition. Access to clean water affects nutritional status by reducing pathogens. Surface water (Rivers, Lakes, Streams, Canals etc.,) is the least desirable source of drinking water. Children from households with piped drinking water are less likely to be stunted than children who drink surface water. In the Dominican republic, Stunting is least common among children in households which obtain drinking water from a well or public tap (DHS comparative studies 12). A fairly clear negative relationship between malnutrition and safe water was observed in a study done by Haga and Kenrick (1985) for 22 countries.

The proportion of children who are classified as Wasted tends to be highest when surface water is the main source of drinking water (DHS comparative studies 12). In urban Uganda Underweight is at least 9 times more common in households using a water source (unprotected

wells or surface water) other than a private tap (UDHS, 1995).

In Ethiopia the National Family and Fertility Survey conducted by CSA in 1990, showed that children from households who drunk safe drinking water had lower chance for disease and mortality than with those who came from households and drunk unsafe drinking water. Since in most African Countries the percentage of population with access to safe drinking water is very low the chance of children being exposed to communicable diseases is very high. For instance, access to safe drinking water for Mozambique is 22 percent, Madagascar 23 percent, Central African Republic 24 percent, Ethiopia 25 percent and for Kenya is 49 percent (World Population Data Sheet 1994).

Since surface water is the most common source of drinking water in Ethiopia (CSA, 1998), it has a significant contribution on the high prevalence of malnutrition. Negussie (1994) also found in Bale region Ethiopia that chronic malnutrition is higher for those who did not use drinking water from piped or protected well. Less than 10 percent of the rural population have reasonable access to a source of potable water. The remaining 90 percent of the rural population depend mainly on traditional sources such as small stream area drainage, cesspools and ponds for their water supply (UNICEF, 1989).

Sanitation facility has also a significant role for the nutritional status of children. Poor sanitation puts infants and young children at risk of incidence, duration and severity of illness (Rutstein, 1996). Poor sanitation results in increased risk of diarrhea disease, which contributes to Undernutrition. The problem is more serious for African Countries. Access to adequate sanitation for these countries are very limited and hence the chance of the risk of diarrhea

disease is very high. Access to adequate sanitation for some selected African countries, for instance for Madagascar is 3 percent, Namibia and Niger 14 percent, Somalia 18 percent, Ethiopia 19 percent and for Kenya is 43 percent (World Population Data Sheet 1994). There are consistent differences in the prevalence of Stunting and Underweight by the type of toilet facility used by child's family. Stunting and Underweight are most common when the child's mother reported no toilet facility. The comparative studies made for 22 countries showed that malnutrition is most common for children from households who reported no toilet facility (A. Elisabeth S. and M. Kathryn Stematz, 1994). The environmental sanitation of Ethiopia is among the worst in the world. Less than 7 percent of the total population has access to adequate refuse disposal systems (UNICEF, 1989).

Diarrhea and other infectious childhood diseases are important contributory causes of Undernutrition in young children, that is, they may diminish a young child's nutritional status preventing the individual from properly digesting or absorbing some of the nutrients consumed. The contribution of malnutrition as measured by anthropometry has been found to be associated with diarrhea (P. Anderson, D. Pelletier and H. Alderman 1995). During episodes of diarrhea, dietary intakes may be lowered by 20 to 40 percent. Respiratory infections have a smaller effect on appetite (H. Mosley and C. Chen 1994). It was found that children with recent diarrhea are more likely Stunted, Wasted and Underweight than children without diarrhea in 22 countries of, North Africa, Asia and Latin America (DHS comparative studies No.12). In Papua-New-guinea a study done by Han-Am and Sleigh (1998) showed that diarrhea had high correlation with chronic malnutrition (Kefene, 1991). In Ethiopia, a study done by Negussie (1994), revealed that, the percentage of stunted children increased for those who were suffering from diarrhea.

Disease like measles, which can be prevented by vaccination cause severe growth retardation and immune supervision. Measles alone is estimated to kill 200,000 children every year (ACC/SCN, 1993). In most countries, levels of chronic malnutrition are the highest among children who were not vaccinated against measles. According to UNICEF (1987) only 17 percent of children in Ethiopia were vaccinated against measles before their first birthday. In Ethiopia, diarrhea and respiratory diseases are the main problems for children under 5 years of age. There are over 100,000 new cases of diarrhea each day (UNICEF, 1989).

### *Demographic Characteristics*

Household demographic behaviors are also among the major contributory cause of malnutrition. Demographic factors such as age and sex of the child which are individual factors, are important correlates of nutritional status. Children's nutritional status is more sensitive for some factors at specific age, for example, during the first 4 to 6 months feeding practices and mother's ability to care for the child are the main determinants of child growth. After the age at which the child starts supplementary feeding (from age 4 to 6 months) through 2 years of age the major influences are weaning practices and exposure to infectious diseases. After 2 years of age household food security have major effect (UN 1990). A survey studied in developing countries by Strauss (1990) showed that height growth starts at age six months, "accentuates" at around two years, and "bottoms out" around the age of four years. Zlotkin (1991) also found height-for-age is highly correlated with age of the child. Kalez (1989), in Indonesia found that severe wasting, on the other hand, carries a higher relative risk in children older than 24 .

Hence one has to consider age in interpreting the cause of failure in the growth of children. cumulative indicators of growth retardation, such as height- for- age, weight -for-age, are

positively related to age, with the lower values achieved by certain age (P. Anderson, D Pettlier and H. Anderson , 1995) .

In some parts of the world, sex preferences believed to have created problem in nutritional status of children. This is as a result of discrimination in allocating food and other household resources (Leslice, 1996). In the Dominican Republic, 25 percent of the boys are classified as stunted compared to 17 percent of the girls. For 18 countries in Sub Saharan Africa, Asia, Latin America and North Africa stunting and wasting are less prevalent among girls than boys (DHS comparative studies No. 12). Phimmasone et al., (1996) studied nutritional status of children in the Lao. The study was focused on the assessment of protein-energy malnutrition ( PEM). The result indicated that girls are less malnourished than boys. In Ethiopia, the 1992 Rural Nutrition Survey shows the prevalence of stunting slightly higher for boys than girls (65.7% and 62.7% for boys and girls respectively) (CSA, 1993). Strong association between the sex of the child and chronic malnutrition was found in southern part of the country in a study done by Eshetu and Ashagre (1997).

The contribution of large household size for undernutrition of children is also well counted. A large household size means too many competitions among household members for food, clothing, shelter, etc. (Davanzo, 1984 as cited in Girma, 1999). Households which have more numbers, are exposed to different types of infectious diseases which in turn affects children's nutritional status. In a survey conducted in Nigeria, more prevalence of malnutrition was observed for family greater than seven children as Morley et al., stated in Alleye et al., (1977) as cited in Gugsu, 1997.

Biologically and socially Children have more attachment with females (mothers) than males. Children who have come from female headed households have better chance of feeding, and care than from those who have come from male headed household. A study done in war-torn society in Ethiopia by Yohannes (1993), showed that children from female headed household had lower prevalence of chronic under-nutrition.

Number of young children (pre-school children present in the household) is also the other factor for Undernutrition. As the number of children per woman increases, fewer household resources are available for each child. In the case of more than one child under age five the mother gives less attention to each child individually and there will be competition for food among children. Various studies have shown that the transmissions of different types of infectious diseases are also facilitated in the case of more than one other under five children in the household which in turn affects the growth performance of children. Mosley and Chen (1984) suggested that crowding may be a risk factor facilitating transmission of respiratory infection, measles and other diseases In Ethiopia a study done in Bale region by Negusie (1994) showed that more percentage of stunted children were observed for one other number of children under five than with no other under five children live in the household.

Birth interval is also another contributory cause for undernutrition. Birth spacing improves infant birth weight and child nutrition. A mother who has short birth interval may not be able to give proper care for a child. Besides as the number of under 5 siblings in a household increases, it may decrease the nutritional status of a child in quantity and quality as well.

Infants born at least 24 month after the previous birth in their family have lower mortality rates than children born at shorter intervals. Closely spaced siblings compete for food and other resources. First born children have lower levels of Stunting than children born after a short birth interval in 16 of 19 countries in Sub-saharan Africa, Asia, Latin America and North Africa. In three-quarters of the countries, stunting is most prevalent among children born after short intervals of less than 24 months (DHS comparative studies No.12). The prevalence of chronic malnutrition for those children born < 24 months are higher than for those > 24 (KDHS, 1993; GDHS, 1998).

Birth order of a child is also another factor associated with nutrition of a child. Comparative studies made by Elisabeth Sommerfelt and M. Kathrynne Stewart (1994) of 22 countries showed that the Sub-Saharan Africa countries, stunting is never common in birth order 2-3. Long term malnutrition is most common among children whose birth order is 6 and more. The highest level of wasting are generally seen among children whose birth order is 4 or higher. The largest proportion of underweight children is usually seen among children whose birth order is 6 or higher. When all the three indicators of undernutrition are considered, there is more undernourishment among children of higher birth order( 4 and above). In part, this may stem from the more limited resources available in larger families; women who bear more children are likely to be of lower socioeconomic status than women with fewer children. In Ethiopia southern parts of the country Eshetu and Ashagre (1997) found that birth order of children are highly associated with chronic malnutrition.

## 1.5. Conceptual Framework

As it is portrayed in figure 1, Socioeconomic, demographic and child care, and environmental factors are assumed to be the major determinants of malnutrition, which in turn are expected to have direct and indirect influences on malnutrition. Their indirect impact is expected to reach the dependent variable (malnutrition) through affecting some variables.

### The Variables:

1) **The dependent variable** is Stunting (height- for- age) which is a measure of the magnitude of malnutrition.

### 2) The independent variables

#### 2.1) Socioeconomic Factors:

##### a) Economic characteristics

Household income is included in this section.

Household income is expected to influence children's nutritional status positively. Increasing household income is an important prerequisite for improved nutritional status of children (A.Berge, 1973 as cited by Negussie, 1996). Hence the higher household income is the better the nutritional status of children.

##### b) Social and cultural characteristics

Cultural factors such as, sex preferences, food given at birth and mother's opinion are included in this section. Cultural factors such as sex preferences have direct and indirect impacts on the nutritional status of children. In many countries, male children are given better share of food in quantity and quality than their counterpart. Mother's education, has also significant

contribution for the nutritional status of children.

Maternal education has a direct impact on the nutritional status of children. Since education creates awareness, mothers who are educated are more expected to provide more nutritious diets and better child care practices for their children. Therefore, in this Thesis mother's education is considered as one of the independent variables.

## **2.2) Child care and Environmental characteristics**

Safe Water, Breastfeeding, vaccination and Disease (diarrhea) come under this category.

### **a) Breastfeeding**

Under the characteristic breastfeeding, practice of breastfeeding has been considered as one of the independent variables. Breastfeeding has a direct impact on child's health. Breastfeeding improves health, the longer a woman breastfeed (up to 4 months exclusive breastfeeding), the better her child's health. Breastfeeding helps to guard the infant against infection, reducing illnesses and deaths from diarrheal and respiratory infections.

### **b) Pure Water and Sanitation**

Safe water and Sanitation are among basic health services. The availability of safe pure water and the existence of healthy environment are directly related with different types of infectious diseases. If the household is with shortage of clean water, the chance of the child to be exposed for different types of communicable diseases is very high. The risk of disease particularly diarrhea is rampant if access to pure water is inadequate.

### **c) Disease**

Infectious diseases are the immediate cause of malnutrition. Infectious diseases that may diminish a young child's nutritional status by decreasing food intake or absorption.

### **2.3) Demographic characteristics**

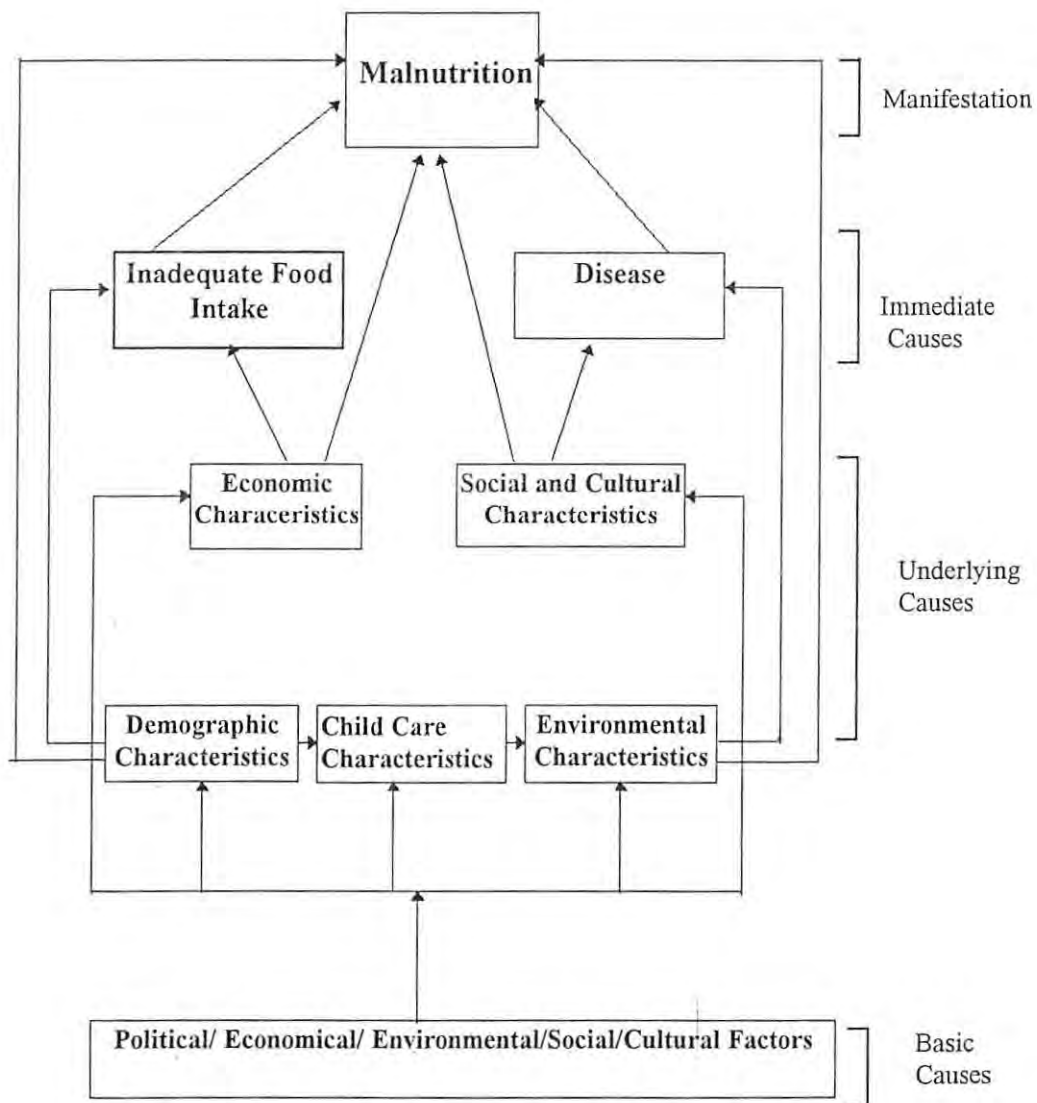
Household size, number of young children who live in the household, age of children, sex of children, sex of head the household and birth order are included in this group.

A larger Household size and number of young children means too many competitions for food among members. Moreover, the care given to each child is minimized which makes the child vulnerable for infectious diseases. The birth order has direct impact on the status of nutrition of children. The food intake per capita of children born after a short interval and the care given by their mother are less and hence their probability to be malnourished is expected to be high. Finally, potential resources and their control that is political, environmental, social and cultural factors will affect the nutritional status of children at macro level through different policies.

Figure 1.1: Conceptual Framework of the Study for the Causes of Malnutrition in

Children

( Adopted From UNICEF and Modified by The Author)



## **1.6. The Study Hypotheses**

1. The higher the income of the household the better would be the nutritional status of children.
2. As household size increases, the risk of child malnutrition increases.
3. Female children have lower nutritional status than male children.
4. Children of women with high birth order are likely to be more undernourished.
5. Safe drinking water has a positive association with children's nutritional status.

## **1.7. Significance of The Study**

The findings obtained from this research will be very useful in many ways. Since the study will reveal the major responsible factors and their relative contribution for the malnutrition of children under five years of age in the areas, the end user governmental and non-governmental organizations could take intervention measures and set appropriate plans to tackle and improve the existing health and nutrition problems by identifying and giving priority for the very poor and vulnerable groups.

The findings are also helpful for policy making, monitoring and evaluation the activities of the government and different concerned agencies. This study will contribute its part by filling the information gap concerning health and nutrition for both the Zones. Finally, the study will be useful for other regions which suffer due to lack of reliable information about health and nutrition status of children under five years of age by indicating the general health and nutrition situations.

## CHAPTER TWO

### 2. SOURCE OF DATA, THE STUDY POPULATION AND METHODS OF THE STUDY

#### 2.1. Source of Data

The source of data for this study is the 1998 Health, Nutrition and Welfare Monitoring Survey, conducted by Central Statistical Authority (CSA) of the government of Ethiopia between March and April. The survey was designed to collect information for the purpose to provide basic information on health nutritional status and welfare of the population in the country which could serve as a vital input for planning, monitoring and evaluation of development programs and preparation of socioeconomic policy assessment of the over all welfare situation in the country with the objectives of providing baseline data on existing poverty situation.

Three questionnaires were administered during the survey. The women's questionnaires (specific characteristics for women), the children's questionnaires (children's characteristics) and the household questionnaires (general household characteristics). During the survey a total of 1827 enumeration areas (EAs) were selected using scientific procedures from both urban (447) and rural (1380) areas from all the 11 regions of the country. The total number of households covered during the survey were 44979 (33895 from rural areas and 11084 from urban centers).

The sampling design adopted for the survey was a two-stage stratified sampling, where EAs served as primary sampling units and households as secondary sampling units for rural areas, concerning urban centers, a two- stage stratified sampling design was applied for ten major urban centers, where EAs and households serve as primary and ultimate sampling units. A

three stage stratified sampling design was applied for other urban centers, where urban centers, EAs and households served as primary, secondary and ultimate sampling units.

Systematic sampling technique was applied for the selection of EAs for both urban and rural areas of the country. All households were listed in each EAs and households were selected finally from urban and rural areas.

The procedures of selection of EAs and households for Misrak Gojjam Zone and Semen Wello Zone are the same as the ones described above. A total of 30 EAs and 750 households were selected for Misrak Gojjam Zone, and similarly 30 EAs and 750 households were selected for Semen Wello Zone. No urban center was selected for both Misrak Gojjam and Semen Wello Zones. Anthropometric measurements were taken for all children who were 3-59 months of age within the sampled households. Trained interviewers from CSA collected data on demographic characteristics which include household size, sex of household, age of the child, sex of the child, number of other under-five children in the household, birth order of the child; socioeconomic characteristics which include income of the household, maternal education, food given at birth, mother's opinion about the performance of child growth child care and environmental characteristics which include duration of breastfeeding, source of drinking water, diarrhea and vaccination.

## **2.2. Data Quality Check**

Before making analysis it is customary to check the quality of the data. For the purpose heaping of height and weight measurements and evaluation of the reported age are being examined.

### *Heaping of Height and Weight Measurements*

There may be a systematic bias in the reading or recording of measurements. If there is no digit preference at all, one would expect to see an even distribution of the readings on each of the ten first decimal places, that is, 10 percent of the measurements should fall on each. The most common decimals to exhibit heaping are .0 and .5. Twenty percent of the readings should fall on either the .0 or the .5 decimal place (Macro International Inc, 1994).

### *Height*

Table 1 shows heaping on decimal places for the height readings.

As can be seen from the Table, in Misrak Gojjam Zone the heaping is greater reading than Semen Wello Zone which is about two times more from the expected.

Table 2.1 : Heaping of Height readings: Percentage of Recorded Height Ending With .0 and .5, Ratio of the Proportion of Recorded Height Ending With .0 and .5 to The Expected Proportion, by Zone, 1998.

Zone	Percent of Height reading endings on . 0	Percent of Height reading endings on . 5	Height heaping Ratio (HHR) <sup>1</sup>	Number of Height Reading
Misrak Gojjam	23.4	18.6	2.1	457
Semen Wello	19.7	16.9	1.8	549
Both Zones	21.2	18.3	1.9	1006

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

<sup>1</sup> Ratio of percentage of height readings endings with .0 or .5 divided by the expected percentage.

### *Weight*

The degree of heaping in decimal numbers of the weight measurement is shown in Table 2.

There is a tendency of heaping towards to .0 and .5 for both Misrak Gojjam and Semen Wello Zones. Column 4 of Table 2 shows, the degree of heaping on both of these decimals ( .0 and .5) combined. The extent to which heaping occurs is indicated by the ratio of the proportion of weight readings ending in .0 or .5 divided by expected proportion. If the ratio is one, then it reflects no heaping. As shown in the table, the greater degree of heaping was observed in Semen Wello Zone, which is more than three times more from the expected.

**Table 2.2: Heaping of Weight Readings: Percentage of Recorded Weight Ending With .0**

**and .5, Ratio of The Proportion of Recorded Weights Ending With .0 and .5 to the Expected Proportion, by Zone, 1998.**

Zone	Percent of weight readings ending on . 0	Percent of weight readings ending on . 5	Weight Heaping Ratio (WHR) <sup>1</sup>	Number of weight Readings
Misrak Gojjam	29	26	2.8	457
Semen Wello	41.4	25.3	3.3	549
Both Zones	34.9	25.6	3.0	1006

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

<sup>1</sup> Ratio of percentage of weight readings endings with .0 or .5 divided by the expected percentage.

### *Improbable Measurements : Flagging of The Z-scores*

Height- for-age, weight- for-height, and weight- for -age Z- scores are calculated according to the guidelines developed by the Center for Disease Control (CDC) and recommended by the World Health Organization WHO. Improbable measurements (flagged Z-scores) are defined as “ Z- scores for height -for-age and weight for-age that fall below -6 standard deviation, Z score for weight for-height below -4 standard deviation, or Z scores for any index above 6 standard deviations” (Macro International Inc, 1994) .

The percentage of flagged Z score is presented in Table 3. From the table, it can be observed that 4.8 percent is flagged for weight-for-age of Z scores, 3.8 percent is flagged for height-for-age Z score and 1.09 percent is flagged for weight-for-height Z score to Misrak Gojjam Zone, while for Semen Wello Zone, 6.2 percent is flagged for weight-for-age of Z scores, 5.1 percent is flagged for height-for-age Z-scores and 0.73 percent is flagged for weight-for-height Z-scores. For the analysis of this study all flagged Z-scores are omitted. Generally, we can conclude that children for whom anthropometric measurements were collected were fairly representative of the children eligible for inclusion, in both Zones more than 94 percent of the eligible children were weighed and measured. Missing data was not common and heaping of height and weight, measurements on the digit .0 and .5 did not present a problem in the survey.

**Table 2.3: Percent Flagged Z scores by Zone, 1998.**

Zone	Percent of height-for-age Z score flagged	Number of children with height measurement	Percent of weight-for-height Z score flagged	Number of children with weight measurement	Percent of weight-for-age score flagged	Number of children with weight measurement
Misrak/G	3.8	457	1.09	457	4.8	457
Semen/W	5.1	549	0.73	549	6.2	549

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

## *Age Reporting*

Age data consists a major source of demographic data, because most of the characteristics of persons (individuals) depend on age and also classified by age. Much of the health and demographic information used are expressed in terms of the age at which some incidence occurs.

Out of the three indices, height-for-age, weight-for-age and weight-for-height used for this study two of them depend on the age of children. Anthropometric result of this study, like many studies in Africa may be affected by incomplete reporting (missing data), field imputation of birth date by the interviewer, and accuracy of reporting due to systematic over-or under reporting, e.g, heaping on preferred digits such as 12 or 24 months ( Macro International Inc, 1994).

From the total sampled parents only 2.9 percent didn't report a month and year of birth of their children. In Semen Wello (2.6%) Zone month and year of birth were less likely to be missing than Misrak Gojjam Zone (3.9%). In order to retain the quality of the data, those children whose ages were not reported were excluded from the analysis. For this survey, mothers (fathers) reported date of birth for almost all children (90.5 %), only about 9.5 percent a month and year of birth was computed by the interviewer in the field, when mothers (fathers) couldn't give exact information. The accuracy of reporting due to systematic over or under reporting is also checked. Here, there is no evidence of heaping on multiples of 12 months of age, because, at the time of data collection there was intensive effort to obtain the exact age of children from different reliable sources.

### 2.3. The Study Area

Amhara is the second populous region among the 11 regions of Ethiopia. According to the 1994 Population and Housing Census the region has 13,834,297 population (CSA,1998). The average calories intake per person per day was 1931.92 calorie for the region (CSA, 1998). The region's per capita income was 980.53 Birr (CSA, 1998). The region is located in the north western part of the country.

Misrak Gojjam and Semen Wello Zones are two of the 11 Zones of the region. Misrak Gojjam Zone is located in southern part of the region, while Semen Wello is in the north. According to CSA, 1998 report, the population of Misrak Gojjam was 1,700,331 and that of Semen Wello was 1,260,317. Out of this under five children of Misrak Gojjam Zone was 217,542 (12.79 %) and that of Semen Wello Zone was 186,781 (14.82 %).

Misrak Gojjam Zone has average density of 113 persons per square killometer, while that of Semen Wello Zone is 85 persons per square killometer.

The major ethnic groups found in both Zones are Amhara (dominantly) and Oromo.

The main climate feature in both Zones is the long rainy season from July and August this is followed by a long dry spell from December to March and short rains come between April and June. Rain fed agriculture is the main stay of both Zones economy. For Misrak Gojjam according to their importance, Teff, Wheat, Barley, Maize and in the border of Nile, Sorghum and for Semen Wello Sorghum, Wheat, Barley, Teff, and Millet are the major agricultural products. According to MEDAC and DPPC, Misrak Gojjam Zone is one of food secure areas while Semen Wello Zone is food insecure area.

There are marked socioeconomic, demographic, health and environmental differentials in Misrak Gojjam and Semen Wello Zones. According to the 1994 Population and Housing Census result (CSA,1998), from the total population of Misrak Gojjam and Semen Wello Zones 1,555,036 (91.5%) and 1,171,262 (93.0%) reside in rural areas respectively. The infant and under five mortality were 113 and 165 per 1000 for Misrak Gojjam Zone while for Semen Wello it was 142 and 211 per 1000. This shows that higher infant and child mortality was observed in Semen Wello Zone.

According to the 1994 Population and Housing Census result (CSA,1998), the percentage of literacy for Misrak Gojjam and Semen Wello Zones was 18.77 percent and 13.34 percent, respectively. The life expectancy of Misrak Gojjam Zone and Semen Wello Zone was 46.0 and 51.5 years, respectively. The adjusted TFR of Misrak Gojjam Zone was 6.45 while it was 8.11 for Semen Wello Zone.

According to the Ministry of Health report of 1999, Misrak Gojjam Zone has 1 Hospital having 100 beds, 20 Clinics, 3 Pharmacies, 56 Health Centers, 37 Health Posts and 2 Drugshops. On the otherhand, Semen Wello Zone has 1 Hospital having 80 beds, 30 Clinics, 2 Pharmacies, 62 Health Centers, 27 Health Posts and 1 Drugshop. From this, we may say that Misrak Gojjam, has a better health facilities. In Misrak Gojjam Zone about 89.44 percent and Semen Wello Zone 72.28 percent of the total population had no access of safe drinking water, and those population who had toilet facility in Misrak Gojjam and Semen Wello Zones were only 2.21 percent and 2.07 percent respectively (CSA, 1998).

## 2.4. Methods of Data Analysis

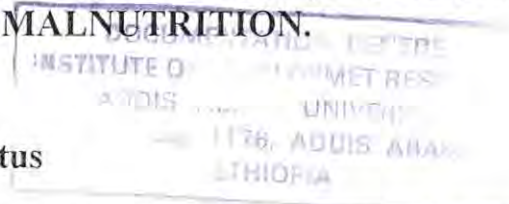
The method of data analysis is both descriptive and statistical, in these descriptive and statistical methods univariate, bivariate and multivariate techniques were employed. The background characteristics of the respondent populations were estimated using univariate analysis. Examining the relationships of those independent variables and stunting was done using the bivariate analysis. In bivariate analysis only the gross (not controlled) effect of the explanatory variables could be examined. A chi-square test was used to see the association of the independent variables and stunting. The relative effect of the independent variables (predictors) on long term malnutrition was captured using a multivariate technique.

The biological, health, social, environmental and economic factors were used in logistic regression model to explain stunting among children less than 5 years of age. The logistic regression method is used in the multivariate analysis since the nature of dependent (outcome) variable under consideration is dichotomous (binary), where the outcome has only two values, that is an event can either occur or does not occur. For this study either “ yes” for stunted children or “ no’ for those children who were not stunted, is used.

The analysis of the result will be presented in the form of odds ratios, (that is the ratio of the probability that the event will occur to the probability it will not). This model estimates the probability that stunting will occur. Regression estimates greater than 1 indicates that the risk of malnutrition is greater than that for the reference category; estimates less than 1 indicates that the risk of malnutrition is less than that for the reference category. P- values will be used to determine the significant level of the regression coefficients in the multivariate analysis.

## CHAPTER THREE

### 3. BASIC INDICATORS OF NUTRITIONAL STATUS, CHARACTERISTICS OF THE STUDY POPULATION, PREVALENCE AND CHANGES OF MALNUTRITION.



#### 3.1. Basic Indicators of Nutritional Status

The assessment of nutritional status is based on the concept that in a well-nourished population the distribution of children's height and weight, at a given age will approximately follow a normal distribution. This means that about 68 percent of children will have a height or weight within 1 or 2 standard deviation of the mean for that age. About 14 percent of children will have a weight or height within 1 or 2 standard deviations of the mean for that age of the remainders, 2 percent will have a height less than 2 standard deviations from the mean of that age. Because all populations have similar genetic potential for growth (Habicht et al, 1974), the United States National Center for Health Statistics (NCHS) reference data are recommended by WHO (1979) to be used in the evaluation of nutritional status.

Since children's height and weight change with age, the World Health Organization (WHO) recommends that height and weight be related to age and that weight be related to height, taking the sex of the child into consideration (WHO working group, 1986). Z-score (or standard deviation) of child is the deviation of the value for an individual from the median value of the reference population, divided by the standard deviation for the reference population.

The measurement of height and weight of a child for a given age and sex could be expressed in terms of Z-scores, or standard deviation score which can then be used to compare the child or

group of children with a reference population. A fixed Z-score interval implies a fixed height or weight difference for children of a given age (WHO,1995). For this study a software called ANTHRO was used for the transformation into Z-score.

The recommended international reference data were developed by NCHS, and individuals who fall below certain commonly accepted cut off points are regarded as malnourished to varying degrees (A. Ashworth and Elizabeth Dowler, 1991). Anthropometric measurements provide one of the most important indicators of children's nutritional status. The most frequently used anthropometric indices to determine the nutritional status in infants and children are height-for-age, weight-for-height and weight-for-age. This study also uses these internationally accepted indices.

#### **Height-for-age (Stunting)**

The height-for-age index provides an indicator of linear growth retardation. Children whose height-for-age is below minus two standard deviation (-2SD) from the median of the reference population are considered short for their age, or stunted. Children who are below minus three standard deviation (-3SD) from the reference population median are severely stunted. Stunting of a child's growth may be the result of a failure to receive adequate nutrition over a long period of time or of the effects of repeated episodes of illness, particularly diarrhea. Height-for-age, therefore, represents a measure of the outcome of undernutrition in a population over a long period and does not vary appreciably with the season of data collection.

### **Weight-for-height (Wasting)**

The weight-for-height index measures body mass in relation to body length. Children whose weight for height measures are below minus two standard deviation (-2SD) from the median of the reference population are too thin for their height, or wasted, while those whose measures are below minus three standard deviations (-3SD) from the reference population median are severely wasted. Wasting represents the failure to receive adequate nutrition during the period immediately before the survey. It may be the result of recent episodes of illness or acute food shortage.

### **Weight-for-age (Underweight)**

Weight-for-age is a composite index of height-for-age and weight-for-height. Children whose weight-for-age measures below minus two standard deviation(-2SD) from the median of the reference population are underweight for their age while those whose measures are below minus three standard deviation (-3SD) from the reference population median are severely underweight. Being underweight for one's age, therefore, could mean that a child is stunted, or wasted or both stunted and wasted.

## **3.2. Demographic and Socioeconomic Characteristics of Respondents**

Long term malnutrition of children is associated with different socioeconomic, demographic, child care and environmental variables in many surveys in the world. Background characteristics of the households have significant contribution for the prevalence of malnutrition differential.

Therefore, having knowledge on the background characteristics which are responsible for the level, trend and differential of children malnutrition greatly assists in understanding the factors

responsible in detail and to take appropriate measures in order to overcome the problems.

### ***Birth Order***

As can be seen from Table 3.1, out of the total sample children for Misrak Gojjam and Semen Wello Zones 17.5 and 20.8 percent are of birth order 1, while 33.0 and 32.8 are of birth order 2-3, respectively. The highest proportion was observed for birth order 4 and above for both Misrak Gojjam and Semen Wello Zones, which are 49.5 and 46.4 percent, respectively. In both Zones a similar trend is observed, that is as the birth order increases, the proportion of children also increases.

### ***Child's Age***

The age distribution of sampled children is presented in Table 3.1. It can be seen from this table that the distribution does not show a consistent pattern for both Zones. The highest proportion of children are observed in the age group 12-23 months for Misrak Gojjam Zone while for Semen Wello Zone the highest proportion is in the age group 48-59 months. For both the Zones together the lowest proportion is observed in the age group 3-11 months, which is 13.7 for Misrak Gojjam and 14.4 for Semen Wello Zone.

### ***Diarrhea***

The distribution of Table 3.1 reflects that, almost three-fourth of children in each Zone and both Zones together had diarrhea. Among sampled children, 339 (74.2%) of Misrak Gojjam Zone, 434 (79.1%) of Semen Wello Zone and 773 (76.8%) of both Zones together had diarrhea case.

### ***Household Size***

When we assess the status of sampled household by household size, it is observed that for both the Zones, majority of households have 4-7 members living together, 76.1 percent for Misrak Gojjam Zone and 71.9 percent for Semen Wello Zone, respectively. The proportion of households who have 8 and above members are the lowest for both Zones, that is 11.2 percent for Misrak Gojjam Zone and 12.9 percent for Semen Wello Zone, respectively.

### ***Household Income***

Highest percentage of households had lowest annual income in the range of 0-700 Birr for both Misrak Gojjam (64.8) and Semen Wello Zone (57.7), which shows the majority of sampled households were poor. For each Zone and both Zones the lowest proportion is observed for those households whose annual income is above 1500 Birr (Table 3.1).

### ***Mother's Education***

It has been clearly described in the literature's review part that mother's education directly or through some other variables indirectly affects the nutritional status of children, that is in general as mothers education increases the nutritional status of children shows improvement. Table 3.1 shows that 89.1 percent, 88.3 percent and 88.7 percent of the sampled mothers were uneducated for Misrak Gojjam Zone, Semen Wello Zone and both Zones together, respectively. This high prevalence percentage of illiteracy may have strong impact on chronic malnutrition in the areas.

### *Mother's Opinion*

Various literature indicates that mother's opinion about the child's growth performance is a social factor that has a direct influence on the nutritional status of children. From Table 3.1, we can observe that, the same type of distribution is observed for both Misrak Gojjam Zone and Semen Wello Zone, that is Higher percentage of mothers in both Zones reported the growth performance of their children as 'good', 69.8 percent in Misrak Gojjam Zone and 74.1 percent in Semen Wello Zone.

### *Sex of a Child*

As can be seen from Table 3.1, high proportion of male children are observed for each Zone. Misrak Gojjam Zone had slightly higher proportion of male children (54.3%) than that of Semen Wello (50.8%). Sex preference for children might bring variation in the nutritional status of children. Although there are various reasons for the preference, the reason can broadly be classified as economic, religious, social and biological.

### *Sex of The Head of The Household*

As can be seen from Table 3.1, the majority of the sampled households were headed by males in each Zone and both Zones together. A slightly higher proportion was observed for the households headed by females in Misrak Gojjam Zone (9.4%) as compared to Semen Wello Zone (8.95%).

### *Vaccination*

As stated in different literatures, vaccination has a role on the nutritional status of children. From Table 3.1, we can observe that the proportion of not vaccinated children for both Misrak

Gojjam Zone (57.3%) and Semen Wello Zone (53.3%) was higher than that of vaccinated children. A higher percentage of vaccinated children was observed for Semen Wello Zone (46.7%) than Misrak Gojjam Zone (42.7%), which might bring variation in the nutritional status of children.

### *Source of Water*

The percentage of distribution of respondents by type of source of water is presented in Table 3.1. It can be seen from the table that, a very high proportion of households used unsafe source of water in Semen Wello (94.2%) and Misrak Gojjam Zone (79.4%), respectively. Since contaminated source of water (lakes, rivers, streams etc.) are the main cause of diarrhea and other diseases, this significant difference observed in the two Zones may also bring variations in the nutritional status of children who are living in the areas.

**Table 3.1: Percentage Distribution of Sampled Households for Background Characteristics by Zone, 1998.**

Background Characteristics	Misrak Gojjam		Semen Wello		Both Zones	
	Number	Percent	Number	Percent	Number	Percent
<b>Birth Order</b>						
1	80	17.5	114	20.8	194	19.3
2-3	151	33.0	180	32.8	331	32.9
4 and above	226	49.5	255	46.4	481	47.8
<b>Child's Age</b>						
3-11	61	13.3	79	14.4	140	13.9
12-23	114	24.9	120	21.9	234	23.3
24-35	82	17.9	107	19.5	189	18.8
36-47	111	24.3	106	19.3	217	21.6
48-59	89	19.5	136	24.8	226	22.4

Table 3.1 : ( Contd.)

<b>Diarrhea</b>						
Yes	339	74.2	434	79.1	233	76.8
No	118	25.8	115	20.9	773	23.2
<b>Household Size</b> ✓						
1-3	58	12.7	83	15.1	141	14.0
4-7	348	76.1	395	71.9	743	73.9
8 and above	51	11.2	71	12.9	122	12.1
<b>Household Income</b>						
0-700	296	64.8	317	57.7	613	60.9
701-1500	112	24.6	161	29.3	273	27.1
Above 1500	49	10.7	71	12.9	120	12.0
<b>Mother's Education</b> ✓						
Not Educated	407	89.1	485	88.3	892	88.7
Educated	50	10.9	64	11.7	114	11.3
<b>Mother's Opinion</b>						
Good	319	69.8	407	74.1	667	66.3
poor	138	30.2	142	25.9	339	33.7
<b>Sex of a child</b> ✓						
Male	248	54.3	279	50.8	527	52.4
Female	209	45.7	270	49.2	479	47.6
<b>Sex of The Head of Household</b> ✓						
Male	414	90.6	500	91.1	914	90.9
Female	43	9.4	49	8.9	92	9.1
<b>Vaccination</b>						
Not vaccinated	262	57.3	292	53.3	555	55.2
Vaccinated	195	42.7	256	46.7	451	44.8
<b>Source of Water</b> ✓						
Safe	94	20.6	32	5.8	880	12.5
Unsafe	363	79.4	517	94.2	126	87.5

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

### 3.3. Prevalence of Malnutrition

The prevalence of malnutrition in both Zones together, Misrak Gojjam' and Semen Wello Zones is high, with 67.9 , 67.0 and 68.9 percent of children less than five years of age being stunted, 8.9, 8.9 and 9.0 percent of them wasted and 58.0, 58.3 and 57.5 are underweight (Table 3.2). In other words about two in every three children is too short and about one in eleven is too thin, these are about 30 and 3.8 times more, respectively the level that would be expected in a healthy, well nourished population.

Of the children who are stunted, about 75 percent, 58.1 percent and 66.9 percent of them are severely stunted ( below -3SD) in Misrak Gojjam Zone, Semen Wello Zone and both Zones together, respectively (Table 2). Likewise for both Zones together and each Zonet about 27 percent of wasted children are severely wasted ( below -3SD) (Table2). The percentage of children who are severely underweight ( below -3SD) in Misrak Gojjam Zone, Semen Wello Zone and both Zones together are, 37.2 percent, 39.7 percent and 38.5 percent, respectively. In a healthy, well-nourished population only 1 in 1000 children is expected to be severely undernourished (Macro International, 1996).

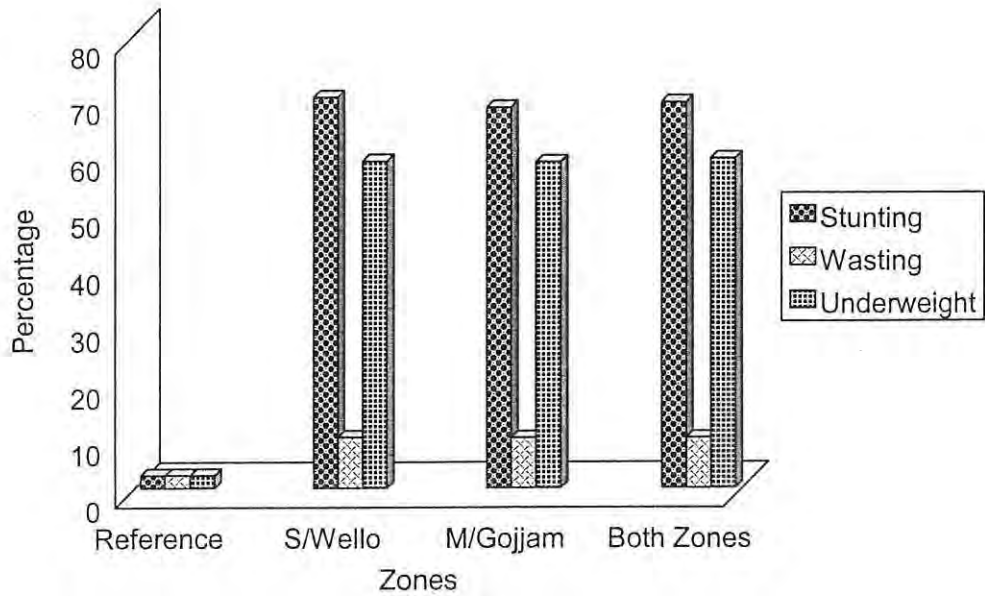
In Semen Wello Zone, the level of stunting and wasting is slightly higher than that of Misrak Gojjam Zone, while the level of underweight is higher for Misrak Gojjam Zone than that of Semen Wello Zone. In general in this study, in all the three indicators both Misrak Gojjam and Semen Wello Zones have almost the same prevalence of acute and chronic malnutrition.

Table 3.2 : Percentage Prevalence (level) of Malnutrition for Misrak Gojjam, Semen Wello and Both Zones Together.

Zone by Sex	Height-for-age		Weight-for-height		Weight-for-age		Numbers
	-3SD	-2SD	-3SD	-2SD	-3SD	-2SD	
<b>Both Zones</b>							
Male	47.2	66.6	2.1	9.9	22.6	60.2	527
Female	43.4	69.3	2.7	7.9	21.9	55.5	479
Total	45.4	67.9	2.4	8.9	22.3	58.0	1006
<b>Misrak Gojjam</b>							
Male	59.0	66.7	1.6	10.5	22.2	60.2	248
Female	41.0	67.4	3.3	7.2	21.1	56.3	209
Total	49.9	67.0	2.4	8.9	21.7	58.3	457
<b>Semen Wello</b>							
Male	51.5	66.2	2.5	9.3	22.9	60.1	279
Female	48.5	71.8	2.2	8.5	22.6	54.5	270
Total	40.0	68.9	2.4	9.0	22.8	57.5	549

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

**Fig. 3.1: Malnutrition Among Children Aged 3-59 Months**



**Fig. 3.2: Chronic Malnutrition of Children Under Five Years of Age**

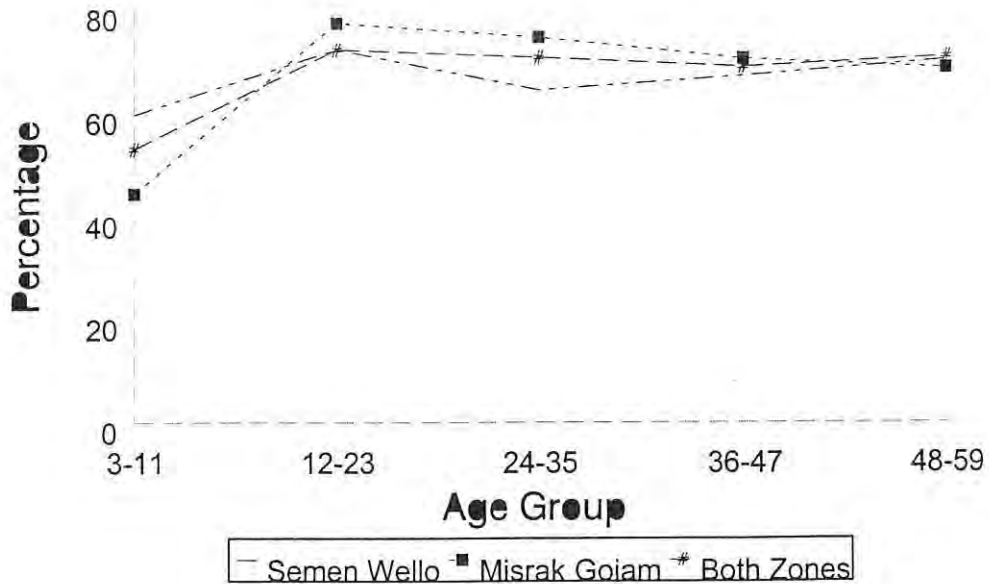


Figure 1 presents the level of malnutrition for Misrak Gojjam, Semen Wello and Both Zones

Figure 1 presents the level of malnutrition for Misrak Gojjam, Semen Wello and Both Zones together. As it is clearly seen, the levels of Stunting, Wasting and underweight are much higher than that of the reference population for each and both Zones together. Age of children by chronic malnutrition is presented in Figure 2. Like many other studies, the peak age for chronic malnutrition is observed in the age group 12-23 months for each Zone and both Zones together.

### 3.4. Changes in Malnutrition

There are only two sources of data available concerning the nutritional status of children for Misrak Gojjam and Semen Wello Zones. The 1992 Rural Nutrition Survey and the 1998 Health and Nutrition Survey, both were conducted by Central Statistical Authority (CSA). In both surveys, anthropometric data were collected for each Zone.

**Table 3.3: Percentage Prevalence (level) of Malnutrition of 1992 and 1998 Survey for Misrak Gojjam, Semen Wello and Both Zones Together.**

Indicators	Year			
	1992 <sup>1</sup>		1998 <sup>2</sup>	
	Misrak Gojjam	Semen Wello	Misrak Gojjam	Semen Wello
Stunting	68.9	68.6	67.0	68.9
Wasting	13.3	8.7	8.9	9.0
Underweight	54.1	53.0	58.3	57.5

Source: <sup>1</sup> CSA 1992

<sup>2</sup> Computed by the Author from the 1998 Health and Nutrition Survey.

As can be observed from Table 2, the level of stunting and wasting decreased from 1992 to 1998 for Misrak Gojjam while slightly increased for Semen Wello Zone, but the level of underweight increased for 1998 as compared to 1992 for each Zone. Generally, a more change in the level of malnutrition is observed for Misrak Gojjam Zone than Semen Wello Zone during the period 1992 to 1998.

## CHAPTER FOUR

### 4. RESULTS OF THE STUDY

#### 4.1. DIFFERENTIALS OF CHRONIC MALNUTRITION

##### *4.1.1 Birth Order of Children and Chronic Malnutrition*

Table 4.1.1 shows the percentage distribution of stunted children by the birth order of children. As depicted in the table, long term malnutrition increases as the birth order of children increases. In most countries, children of higher birth order tend to have higher levels of undernutrition, indicating that children from larger families have worse nutritional status. Besides, higher parity women experience greater pregnancy and birth related complications than women at second or third parity, and their children may experience poorer intrauterine growth and low birth weight (Hagga and Mback, 1993).

Birth order 4 and above has the highest stunted percentage, for Misrak Gojjam (71.3%), Semen Wello (69.4%) and both Zones together (69.6%). The lowest percentage stunted children were observed for children of order 1, that is for Misrak Gojjam (66.2%), Semen Wello (63.9%) and both Zones together (65.0%). Similar findings were observed at different times (a study conducted in Philippines by Horton, 1988; comparative studies made based on 22 countries by A. Elisabeth sommerfelt and M. Kathryn Stewart, 1994; CSA, 2000; KDHS, 1993). When comparison is made for each Zone, the percentage of stunted children for birth order 1, 2-3 and 4 and above is higher for Misrak Gojjam Zone than Semen Wello Zone.

**Table 4.1.1: Percentage of children age 3-59 months who are stunted, by order of birth.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
1	66.2	63.9	65.0
2-3	69.9	66.7	68.6
4 and above	71.3	69.4	69.6

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.2 Age of The Child and Chronic Malnutrition*

In Table 4.1.2 children's age by chronic malnutrition is presented. The results in the table revealed that the existence of variation in chronic malnutrition at different ages, for each Zone and both Zones together. Lipsitt et al., (1985) research shows that children are "keenly sensitive in the first few months of life to subtle changes in gustatory stimulation"; although their behavior is primarily reflexive, they show a marked preference for sweetness. During the first six months infants shift from primarily reflexive control of responses to voluntary control. A dislike appears even on first food presentation and become stable by the second year of life. Analyzing the magnitude of undernutrition at different ages reveals how nutritional status changes during child's first five years of life.

This study shows that the highest percentage of stunting is observed for age group 12-23 in Misrak Gojjam (77.2%), Semen Wello ( 72.1%) and both Zones together (72.0%) and the lowest prevalence of stunting is observed for the age group 3-11 for Misrak Gojjam (44.3%), Semen Wello ( 59.5%) and both Zones together (52.9%). Given that stunting is a cumulative process, it is not surprising that age is significantly related to long term malnutrition. These results are in conformity with other studies (A. Elisabeth S. and M. Kathryn Stewart, 1994;

Gugsa, 1997; C.S.A 2000). When observation is made by Zone, Stunting is higher in Semen Wello Zone for age group 3-11 and 48-59 than that of Misrak Gojjam Zone. While for the age group 12-23 , 24-35 and 36-47 Stunting is higher for Misrak Gojjam Zone than Semen Wello Zone.

**Table 4.1.2: Percentage of Children Age 3-59 Months Who Are Stunted by Zones.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Age in Months			
3-11	44.3	59.5	52.9
12-23	77.2	72.1	72.0
24-35	74.4	64.2	70.5
36-47	70.3	67.0	68.7
48-59	68.5	70.1	69.1

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

### **4.1.3 Diarrhea and Chronic Malnutrition**

As presented in Table 4.1.3 Variations in the nutritional status of children were observed by diarrhea in the previous two weeks for each Zone and both Zones together. One of the most frequent causes of malnutrition is diarrhea. Diarrhea causes decreased nutrient absorption, decreased dietary intake, and increased catabolism. This is an expected result, since the majority of households of the study areas source of water were river/lake or unprotected well which is contaminated mostly and favorable source for diarrhea causing fatal sickness in children. Diarrhea can become a threat to children's lives because it causes direct nutrient losses as well as individuals imbalance in body fluids and electrolytes that are associated with

dehydration.

As can be seen from the table, the findings of this study also in agreement with the above truth for each Zone and both Zones together. Prevalence of Stunting was higher for those children who experienced diarrhea during the two weeks preceding the survey for each Zone and both Zones together. Similar findings have been observed, for instance according to DHS Comparative Studies No12 in developing countries children with recent diarrhea have more chance of being malnourished than those of without diarrhea (A.Elisabeth S. and M.Kathryn S., 1994). In Ethiopia, findings by Gugsa (1997) Southern nations nationality people (SNNP) and Negussie (1994) for Bale region is in agreement with this findings.

**Table 4.1.3 : Percentage of Children Age 3-59 Months Who Are Stunted by Diarrhea**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Diarrhea			
Yes	69.3	72.2	70.0
No	67.8	65.7	67.3

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### **4.1.4 Household Size and Chronic Malnutrition**

Table 4.1.4 presents the percentage distribution of Stunted children by household size. As can be seen from the table, the same pattern of stunting is observed for Misrak Gojjam Zone, Semen Wello Zone and both Zones together by different size of the household. The table revealed that, the largest percentage of stunted children was observed for those households with 8 and above member in Misrak Gojjam Zone, Semen Wello Zone and both Zones

together. Similar finding in Ethiopia, by Gugsa, 1997 for southern region and Negussie 1994, for Bale region were observed.

When we observe stunting by Zone, higher percentage of stunted children were observed for families with 4-7 and 8 and above members for Misrak Gojjam Zone than Semen Wello Zone. On the other hand, in Semen Wello Zone higher percentage of stunted children were observed for those families which have 1-3 members than that of Misrak Gojjam Zone.

**Table 4.1.4: Percentage of Children Age 3-59 Months Who Are Stunted by Household Size.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Household Size			
1-3	62.7	65.6	63.9
4-7	69.0	66.0	67.6
8 and above	69.8	67.6	68.6

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### **4.1.5 Household Income and Chronic Malnutrition**

Table 4.1.5 shows the distribution of stunted children by household income. Different studies have shown that, household income have strong positive effect on stunting (Hoorweg et al, 1983; Melaku and Yohannes 1998). With the improvement of household income, absolute expenditure on food, is likely to go up as is the calorie protein intake of the household and also clothing, shelter and sanitary services will be improved ( UN, 1985 as cited in Negussie, 1994). As presented in the table, children who were from households of high economic status are

relatively the least prevalent ones for Misrak Gojjam (65.3%), Semen Wello (60.6%) and both Zones together (62.5%). As expected, high percentage of malnutrition is observed in children who were from low economic status for Misrak Gojjam (70.3.0%), Semen Wello (68.9%) and for both Zones together (68.8%).

Children from middle economic status have also relatively low percentage of malnutrition, that is 67.0, 68.1 and 67.5 for Misrak Gojjam, Semen Wello and both Zones together, respectively. These findings clearly indicate that, poor households could not afford and feed their children with the required types of food and care which directly affects the child's growth performance. Similar findings were also observed in several studies in Ethiopia (CSA,1992; Negussie, 1994; Gugsu, 1997).

**Table 4.1.5: Percentage of Children Age 3-59 Months Who Are Stunted by Household Income.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
<b>0-700 Birr</b>	70.3	68.9	68.8
<b>701-1500 Birr</b>	67.0	68.1	67.5
<b>Above 1500 Birr</b>	65.3	60.6	62.5

Source: Computed by the Author from the 1998 Welfare Monitoring Survey.

#### 4.1.6 Mother's Education and Chronic Malnutrition

Table 4.1.6 shows the percentage of stunted children by mother's education. As explained in the literature's review section, mother's education and children's chronic malnutrition are negatively associated. Maternal education, associated with the behavioral factors affects nutritional status, such as intra-household food distribution, child care practices, feeding behavior and patterns, and food handling procedures (Macro International Inc, 1996 as cited in Gugsu, 1997).

It has been clearly observed from the table that variation was observed in the level of chronic malnutrition between children of mothers who were educated than children of mothers who were not educated for both Zones together and each Zone. For Misrak Gojjam Zone 70.0 percent, for Semen Wello Zone 67.0 percent and for both Zones together 68.4 percent stunted children belonged to uneducated mothers. This shows that the impact of education for chronic malnutrition is considerable.

**Table 4.1.6: Percentage of Children Age 3-59 Months Who Are Stunted by Mother's Education.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
<b>Educated</b>	68.8	67.0	67.8
<b>Not educated</b>	70.0	67.2	68.4

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.7 Mothers Opinion About Child's Growth Performance and Chronic Malnutrition.*

The opinion of mothers about the growth performance of their children can be a factor for stunting. Table 4.1.7 shows the percentage distribution of stunted children by mother's opinion about child's growth performance. Different studies have shown that chronic malnutrition varies by mother's opinion about child's growth performance (Yohannes, 1993; Gulitneh, 1999). The possible reason for such variations, mothers who have the know-how about their children growth performance would know more about proper feeding of their children and also would provide to their children a better care at different ages than with those who have not (little) know-how.

As presented in table 4.1.7, for Misrak Gojjam Zone 69.0 percent of children stunted are from mothers who reported the growth performance of their children is 'good', while for Semen Wello is 72.3 percent. The percentage of children from mothers who reported the growth performance of their children is 'poor' 68.8 percent and 65.4 percent for Misrak Gojjam and Semen Wello Zones, respectively.

When observation is made for both Zones together, 71.8 percent children stunted are from mothers who reported the growth performance of their children is 'good' and 65.7 percent are from mothers who reported 'poor'. However, the result found by this study is contrary to the findings of the earlier studies, this might be because either those mothers who reported the growth performance of their children is 'good' might not have the wright knowledge or they could not afford the required food and care since they are very poor.

**Table 4.1.7: Percentage of Children Age 3-59 Months Who Are Stunted, by Mother's Opinion About Child Growth Performance.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Good	69.0	72.3	71.8
Poor	68.8	65.4	65.7

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.8 Sex of The Child and Chronic Malnutrition*

For a child being a male or female, may bring variation in the level of stunting. Generally, the reasons could be biological, social and economical. Different studies have shown that sex preference by parents and the biological nature of children have brought variation in feeding and care giving for their children, which in turn affects the nutritional status of children (Lesliu, 1996).

Table 4.1.8 shows level of chronic malnutrition by sex of the child. From the table, it is observed that, the percentage of stunting is higher for male children than their counter parts , for each Zone and both Zones together. For Misrak Gojjam Zone, more males (71.8%) are stunted than that of Semen Wello (67.4%). Similar findings of higher prevalence of chronic malnutrition among males than females were observed by different studies in Ethiopia and abroad (Negussie, 1994; Gugsu, 1997; Yohannes, 1993; CSA, 2000 and GDHS, 1998).

**Table 4.1.8: Percentage of Children Age 3-59 Months Who Are Stunted by Sex of The Child.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Sex of The Child			
Male	71.8	67.4	69.3
Female	66.5	66.7	66.6

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.9 Sex Head of The Household and Chronic Malnutrition.*

Long term nutritional status and sex of the head are presented in Table 4.1.9. Children from households which are headed by females have relatively lower risk of being stunted. The possible reasons for this variation, females have more attachment with children biologically and socially than males, so they could follow more closely children's growth performance, hence if females have become head of the household, that means if they are empowered (with decision making and economy) then this may create a better opportunity for children's health care and feeding practice which in turn may benefit more for the normal growth performance of children than from male headed household.

From the table, it is observed that more percentage prevalence of malnutrition was observed for those households which are headed by males, that is, 79.1 percent children who are stunted belong to male headed households and 67.9 percent stunted children belong to female headed households for Misrak Gojjam Zone. Similarly, for Semen Wello Zone 70.7 percent stunted children are from male headed households and 63.3 percent stunted children from female headed households. When we see this observation for both Zones together, 67.4 percent

stunted children are from male headed households while 67.6 percent stunted are from female headed households. This finding is in agreement with other studies (Yohannes, 1993).

**Table 4.1.9: Percentage Children Age 3-59 Months Who Are Stunted by Sex of The Head of Household.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Male	79.1	70.7	67.4
Female	67.9	63.3	67.6

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.10 Vaccination and Chronic Malnutrition*

Table 4.1.10 shows percentage distribution of stunted children by vaccination. Vaccination and chronic malnutrition are positively related. Although it is clearly known that vaccination prevents children suffering from different types of infectious diseases which are the immediate cause of malnutrition, the contrary is observed in this study (Table 4.1.10), that is children who were not vaccinated are less stunted than those who were vaccinated for Misrak Gojjam (68.7%), Semen Wello (66.4%) and both Zones together (67.6%), this might be because, children were vaccinated after they had become chronically malnourished since chronic malnutrition appears at early ages in Ethiopia or it could also be because mothers of those children were themselves malnourished during their pregnancy. Similar findings were observed by Gugsu (1997) for Southern Region in Ethiopia. When comparison is made for each Zone the percentage of children who were vaccinated and stunted is slightly higher for Misrak Gojjam (69.2) than Semen Wello (67.6) Zone.

**Table 4.1.10: Percentage of Children Age 3-59 Months Who Are Stunted by Vaccination.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Vaccinated	69.2	67.6	68.3
Not Vaccinated	68.7	66.4	67.6

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

#### *4.1.11 Source of Water and Chronic Malnutrition*

Table 4.1.11 presents the percentage of stunted children by source of drinking water. Water is thought to affect health primarily by reducing exposure to pathogens. Ingestion of contaminated water (diarrhea disease agents and guineaworm), exposure to pathogens through personal and domestic hygiene can cause disease (P. Anderson, 1995). As can be seen from the table a significant variation of percentage of stunted children is observed in the households who used unsafe water supply for drinking for Misrak Gojjam (72.5%), Semen Wello (78.1%) and both Zones together (74.3%). The possible reason for this, source of drinking water directly or indirectly (mostly through diarrhea) affects the child nutritional status and hence the growth performance of children. More percentage of stunted children for unsafe water is observed in Semen Wello than Misrak Gojjam Zone.

**Table 4.1.11: Percentage of Children Age 3-59 Months Who Are Stunted by Source of Water.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Source of Drinking Water			
Unsafe Water	72.5	78.1	74.3
Safe Water	55.3	66.3	61.1

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

### Chronic Malnutrition by Selected Background Characteristics:

#### A Bivariate Output.

The chi-square test have shown that all variables (except other under five children and vaccination) have significant effect on long term malnutrition (Stunting). As can be seen from table 4.1.15, the percentage of nutritionally stunted children for those households which have 8 and above members and annual income of 0-700 Birr is highest for each Zone and both Zones together. Households which have 1-3 and above members and income of 0-700 Birr have the lowest prevalence of malnutrition in each Zone and both Zones together. A significant variation was observed when we consider it by Zone.

**Table 4.1.12: Percent of Children Age 3-59 Months Who Are Stunted by The Household**

**Income ( 0-700 Birr) According to Household Size.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Household Size			
1-3	66.3	64.1	65.2
4-7	67.0	66.6	66.8
8 and Above	69.8	68.7	67.9

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

Those children who have come from households which used unsafe source of water and suffered from diarrhea had the highest percentage of stunting as compared to those who haven't diarrhea case and used unsafe water. A higher magnitude was observed for Misrak Gojjam Zone than Semen Wello Zone ( Table 4.1.16).

**Table 4.1.13: Percent of Children Age 3-59 Months Who Are Stunted by Source of Water (Unsafe) According to Diarrhea.**

Background Variable	Stunting		
	Misrak Gojjam	Semen Wello	Both Zones
Diarrhea			
Yes	72.8	70.6	71.4
No	71.4	65.3	68.2

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

## 4.2. MULTIVARIATE ANALYSIS

### 4.2.1 The Model Used

As discussed in data analysis section (2.4.), previous chapter, the relative importance of the independent variables are not identified by bivariate analysis. In order to capture the relative importance of the explanatory variables by controlling the confounding effects of the variables a multivariate analysis was employed. The logistic regression method of analysis was used for the purpose.

The logistic regression method is used when the dependent variable is dichotomous (binary). In dichotomous outcome there are only two forms, "yes" or "no". As stated earlier, for this study, since the dependent variable is chronic malnutrition, there are only two possible responses, either "yes" for those children who are stunted ('1' if stunted), and "no", for those who are not stunted ('0' if not stunted).

The equation of the logistic regression model is given as :

$$p/1-p = e^{B_0X_0} * e^{B_1X_1} * e^{B_2X_2} * \dots * e^{B_nX_n}$$

or equivalently,

$$\ln (p/1-p) = B_0 + B_1 X_1 + B_2 X_2 + \dots + B_n X_n$$

Where , P = chance of a child being stunted.

1-p = chance of a child not being stunted.

$\ln (p/1-p)$  = is the probability or risk of event occurring which is the odds of being stunted.

$X_i$  = independent variables.

$B_i$  = regression coefficients.

$B_0 = \text{constant.}$

In the logistic regression model estimates of relative risk have been computed based on the odds ratios from the logistic regressions, the log of odds ratios (which in this study is the ratio of proportion of children who are stunted to those who are not) is expressed as a function of the various explanatory variables (predictors). A relative risk estimate greater than 1.00 indicates an increased risk (or likelihood) for the outcome, while a relative risk estimate less than 1.00 indicates a decreased risk (or likelihood) for the outcome.

For each variable, there is a reference category against which all other values are compared. For this study, the reference category for each variable, the first value in an ordinal series, or the category which is expected to have low prevalence of stunting. By default, the values of these reference categories are given a regression estimate of 1.00. The results of other variables will either be higher or lower than the reference category. Significant levels of regression coefficients are determined using p-values. The statistical package for social sciences (SPSS) was used for all the analysis of this study.

Before running a multivariate analysis, in the bivariate analysis a Chi-Square test has been made to examine whether associations (gross or uncontrolled effect of the explanatory variables on chronic malnutrition) between those explanatory variables and chronic malnutrition exist or not. The Chi-Square test has shown that all variables (except other number of under five children and vaccination) are found to be important factors affecting chronic malnutrition for the children living in each Zone.

In order to assess the problem of collinearity between independent variables, multicollinearity

diagnosis has been made (Appendix 2). Since all the values of Maximum Variance Inflation Factor (VIF) are below 5, there is no collinearity problem (montogomary and peck, 1992 as cited in Girma , 1999). The assumption of constant variance of the error terms is checked using scatter plots of residuals against the predicted values and using the Normal p-plot, the assumption of normality is also assessed, in both cases there has not been observed major problems.

**Table 4.2.1: Results of Logistic Regression of Chronic Malnutrition Differentials of Both Zones Together.**

<b>Background Variable</b>	<b>B</b>	<b>S.E.</b>	<b>Sig T</b>	<b>Exp (B)</b>
<b>Birth Order</b>				
1 <sup>RC</sup>				
2-3	-0.4690	0.1267	0.7113	1.0438
4 and above	-0.1791	0.1019	0.0436**	1.1140
<b>Child's Age</b>				
3-11 months <sup>RC</sup>				
12-23 months	-0.6434	.5400	0.0000***	0.5255
24-35 months	0.4192	.1306	0.0013**	1.5207
36-47 months	0.3642	.1412	0.0099**	1.4394
48-59 months	0.0851	.1331	0.5211	1.0866
<b>Household Size</b>				
1-3 <sup>RC</sup>				
4-7	0.3183	0.1628	0.0432**	1.1309
8 and Above	0.1230	0.1070	0.2503	1.3748
<b>Household Income</b>				
0-700 <sup>RC</sup>				
701-1500	-0.0153	0.0990	0.0433**	0.8813
1501 and Above	-0.5410	0.2663	0.0471**	0.6529
<b>Mother's Opinion</b>				
Good <sup>RC</sup>				
Poor	-0.2589	0.0734	0.0044**	0.7719
<b>Mother's Education</b>				
Educated <sup>RC</sup>				
Not Educated	0.1651	0.1062	0.1199	1.1795
<b>Sex of The Child</b>				
Male <sup>RC</sup>				
Female	0.2231	0.6698	0.0473**	0.7934
<b>Sex of The Head</b>				
Male <sup>RC</sup>				
Female	-0.0874	0.1233	0.4784	0.9163

Table 4.2.1: ( Contd.)

Background Variable	B	Sig T		Exp (B)
<b>Vaccination</b>				
Yes <sup>RC</sup>				
No	0.0161	0.0631	0.6901	1.0224
<b>Source of Water</b>				
Safe water <sup>RC</sup>				
Unsaf water	0.4040	0.1038	0.0001***	1.4979
<b>Constant</b>	-0.3113	0.1432		
<b>n</b>	1006			
<b>-2 Loglikelihood</b>	1284.6			
<b>Adjusted R<sup>2</sup></b>	0.631			

Source:- Computed by the Author from the 1998 Health and Nutrition Survey.

Note:- B- Regression Coefficient

S.E.- Standard Error

RC- Reference category

Significant at p\* < 0.1 p\*\* < 0.05 p\*\*\* < 0.001

n-sample size

**Table 4.2.2: Results of Logistic Regression of Chronic Malnutrition Differentials of Misrak Gojjam Zone and Semen Wello Zone.**

Background Variables	B		Sig T		Exp (B)	
	Misrak Gojjam	Semen Wello	Misrak Gojjam	Semen Wello	Misrak Gojjam	Semen Wello
<b>Birth Order</b>						
1 <sup>RC</sup>						
2-3	0.0814	0.0260	0.4833	0.6780	1.1443	1.0260
4 and Above	0.3018	0.2755	0.6984	0.0187**	1.3331	1.0711
<b>Child'S Age</b>						
3-11 months <sup>RC</sup>						
12-23 months	-0.9439	-0.5114	0.0001**	0.0131**	0.3891	0.5996
24-35 months	0.5529	0.2951	0.0043**	0.1038	1.7384	1.3432
36-47 months	0.2168	0.5049	0.3219	0.0089**	1.2347	1.6511
48-59 months	0.0361	-	0.8502	0.9484	1.0367	1.0677
<b>Household Size</b>						
1-3 <sup>RC</sup>						
4-7	0.1249	0.2212	0.6323	0.0436*	1.0676	1.2016
8 and Above	0.0654	0.1446	0.6969	0.2042	1.1679	1.5625
<b>Household Income</b>						
0-2000 <sup>RC</sup>						
2001-2500	-0.1029	-0.1580	0.0476**	0.0463**	0.9121	0.7328
2501 and Above	-0.1268	-0.3210	0.7843	0.0022**	0.8813	0.5565
<b>Mother's Opinion</b>						
Good <sup>RC</sup>						
Poor	-0.2647	-0.1093	0.0202**	0.0823*	0.7674	0.8270
<b>Mother's Education</b>						
Educated <sup>RC</sup>						
Not Educated	-0.1399	0.4143	0.7655	0.0130**	1.2400	1.4950
<b>Sex of The Child</b>						
Male <sup>RC</sup>						
Female	-0.1998	-0.0926	0.0452**	0.0611*	0.8931	0.9877

Table 4.2.2: (Contd.)

Background Variables	B		Sig T		Exp (B)	
	Misrak Gojjam	Semen Wello	Misrak Gojjam	Semen Wello	Misrak Gojjam	Semen Wello
<b>Sex of The Head</b>						
Male <sup>RC</sup>						
Female	-0.1275	-0.0676	0.4987	0.6862	0.8803	0.9347
<b>Vaccination</b>						
Yes <sup>RC</sup>						
No	0.0846	0.0294	0.4358	0.7522	1.0930	1.0298
<b>Source of Water</b>						
Safe water <sup>RC</sup>						
Unsafe water	0.6927	0.1392	0.0000***	0.3692	1.5091	1.1551
<b>Constant</b>	0.1754	0.0637	0.6346	0.8271		
<b>n</b>	457	549				
<b>-2 loglikelihood</b>	566.6	686.4				
<b>Adjusted R<sup>2</sup></b>	0.6543	0.6320				

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

Note:- B- Regression Coefficient

S.E.- Standard Error

RC- Reference category

Significant at p\* < 0.1 p\*\* < 0.05 p\*\*\* < 0.001

n-sample size

#### ***4.2.2 Stunting and Birth Order***

As can be seen in Table 4.2.1 birth order of children is significantly associated with chronic malnutrition. Children born with high birth order could be at higher risk of malnutrition simply because of many siblings. Many siblings could mean both competition for scarce resources that promote survival (food, preventive and curative medical care, the attention of adults) and increased the opportunities for transmission of infections through both of the main routes (airborne and fecal-oral) (P. Anderson et al., 1995). However high birth order is not always disastrous (Gugsa, 1997).

There is no reason for competition between children for access to care and nourishment unless the household's resources are incapable of completely satisfying the basic needs of the children being cared for. The logistic output revealed that the risk of being stunted for those children whose birth order are 2-3 and 4 and above is higher by 4.4 percent and 11.4 percent, respectively as compared with the reference category (Table 4.2.1). This is in agreement with the assumption of children of high birth order have a higher chance to be stunted than with that of low birth order. A similar finding were observed in Ethiopia by Melaku and Yohannes, 1998; Yohannes, 1993.

When we observe the proportionate effect for each Zone a similar trend was observed. A significant relationship between birth order and stunting was noted for Semen Wello Zone, on the other hand in Misrak Gojjam Zone insignificant relationship was observed between chronic malnutrition and birth order of children. The risk of being malnourished for children whose birth order are 2-3 and 4 and above is higher by 14.43 percent and 33.31 percent for Misrak Gojjam Zone and higher by 2.6 percent and 7.11 percent for Semen Wello Zone as compared

to the reference category (Table 4.2.2).

### **4.2.3 Stunting and Child Age**

For this study age of children was introduced into the model, as hypothesized the logistic regression output for both Zones together revealed that the existence of a positive and significant association between age of children and chronic malnutrition. Similar findings were observed from different studies in Ethiopia (Gugsa, 1997). Unlike bivariate analysis output, after controlling confounding factors, the logistic model showed that the likelihood of being malnourished is highest for age group 24-35 ( 52.07%), on the other hand the lowest is observed for age group 12-23 months. Not surprisingly, the risk of stunting increases with children age as stunting is a cumulative process that occurs over the course of many individual insults of nutritional deprivation and/or illness. This dramatic rise with age reflects the cumulative effects of repeated illness, inadequate nutrient intake and most importantly their interactive effect during this critical period of child development ( Table 4.2.1).

When observation is made for each Zone, both Misrak Gojjam and Semen Wello Zones, children's age is positively and significantly associated with chronic malnutrition. For Misrak Gojjam Zone, the highest risk of being malnourished was observed for age group 24-35 months, which was 73.84 percent higher as compared to those who were 3-11 months old and the lowest was for 12-23 months, which is 61.10 percent lower compared to reference category (3-11 months). Unlike Misrak Gojjam Zone, the highest risk of being malnourished for children was observed for age group 36-47 (65.11%) months old as compared to the reference category (3-11 months), and similar to Misrak Gojjam Zone the lowest is observed for age group 12-23 months which was 40.00 percent lower risk with that of reference

category (3-11 months). Generally, we could say that age has more influence on chronic malnutrition for Misrak Gojjam Zone than Semen Wello Zone (Table 4.2.2).

#### ***4.2.4 Stunting and Household Size***

As explained in the literature review, a larger family size may bring competitions for food and other resources from members in the household and facilitate some type of communicable diseases because of crowds. In this study also, the univariate and bivariate analysis conformed this situation. As hypothesized, the logistic regression model of this study also revealed that, there was a positive and significant association between household size and long term malnutrition after controlling confounding effects. The risk of being chronic malnourished for those children from households who have 4-7 and 8 and above members were higher by 13.09 percent and 37.48 percent, respectively when compared to children from households where their members were 1-3 (Table 4.2.1).

When comparison is made by Zones, like both Zones together, in Semen Wello Zone a positive and significant association existed between household size and stunting, while a positive but insignificant association existed for Misrak Gojjam Zone. From the above table we can also observe that the effect of having more members of households (4-7 and 8 and above) on stunting was more for Semen Wello (20.16 % and 56.25 %) and Misrak Gojjam Zone (6.76% and 16.79%) as compared with households having 1-3 members ( Table 4.2.2).

#### *4.2.5 Stunting and Income of the House hold*

As hypothesized, higher household income was found to be protective for stunting. The logistic regression model showed that a negative and significant association between households income and long term malnutrition. That means as the household income increases the chance of being malnourished decreases. The risk of being malnourished for those children who are from medium and rich households is lower by 11.90 percent and 34.70 percent when compared to those children who are from poor households (Table 4.2.1). The reason behind this could be, those households who had better income had a better chance to provide food items that contained the necessary nutrients required by the children at different ages and also could provide better child care, hence the children have a better balanced growth and development performance than with those children from households who were poor.

Negussie (1994), for Bale region in Ethiopia; Hoorweg et al, 1983 for Muranga district in Kenya have also found similar findings. The 1992, Rural nutrition survey conducted by CSA and Yohannes (1993) for war torn society in Ethiopia also showed that chronic malnutrition was positively and significantly associated with land holding which was a major source of income in rural Ethiopia (CSA, 1984).

When comparison is made by Zone, a significant negative relationship was observed between household income and stunting for Semen Wello and Misrak Gojjam Zones. The chance of being stunted for children from household whose income is 701-1500 Birr and above 1500 Birr is lower by 8.8 percent and 11.90 percent in Misrak Gojjam Zone and lower by 26.70 percent and 44.40 percent in Semen Wello Zone, respectively as compared to the reference category ( Table 4.2.2).

#### *4.2.6 Stunting and Mother's Opinion*

Table 4.2.1 showed that mother's opinion was an important factor that has a negative and significant effect on chronic malnutrition of children. That means when the know-how of mothers about their children's growth performance increases, the chance of their children being stunted decreases. From the table, the likelihood of being stunted for children whose growth performance was reported to be 'poor' lower by 22.80 percent when compared to those children whose growth performance was reported to be 'Good'. The possible explanation for this, mothers who have the know-how about the growth performance of their children take more time to care and make efforts to provide the resources that they have for their children. Similar findings were observed by Yohannes, 1993, in Ethiopia.

When we observe mother's opinion by each Zone similar to both Zones together had a negative and significant relationship with mothers opinion. The logistic result also showed, Misrak Gojjam Zone children whose growth performance was reported to be 'poor'(23.30%) had lower chance of being stunted than that of Semen Wello children (17.30%) as compared to the reference category. This shows that the knowledge of mothers about their children growth performance of Semen Wello children is lower when compared to mothers of Misrak Gojjam Zones or even though the knowledge exists, the available resources is more limited for Semen Wello children as compared to Misrak Gojjam children (Table 4.2.2).

#### ***4.2.7 Stunting and Mother's Education***

The logistic output revealed a similar trend between mother's education and chronic malnutrition as that of the univariate and bivariate approaches. The risk of being stunted for children of uneducated mothers is higher by 17.95 percent as compared to those children of mothers who are educated for both Zones together. The possible explanation for this considerable variation is that educated mothers might have changed their wrong traditions (beliefs) about feeding practice of their children, they may provide a better care and also they have a better chance to protect from different types of infectious diseases (Table 4.2.1).

When observation is made in each Zone, a positive and significant association between mother's education and chronic malnutrition was observed in Semen Wello Zone. Besides, the risk of being stunted for children from uneducated mothers is higher by 49.50 percent as compared with those children who belonged to educated mothers. On the other hand, though insignificant association between mother's education and chronic malnutrition was observed in Misrak Gojjam Zone a meaningful negative relation was noted. In this Zone the risk of being stunted for children from uneducated mothers is higher by 24.00 percent as compared with those children who belonged to educated mothers (Table 4.2.2).

#### ***4.2.8 Stunting and Sex of The Child***

In the case of sex of the child, as hypothesized the logistic regression model had shown that a significant relationship between stunting and sex of the child. In agreement with the literature review, the logistic regression model showed, the risk of being malnourished for female children was lower by 20.70 percent when compared with male children. The possible reason for this, the differential may have been brought biologically or because of the sex preference

attached with the traditions (culture), which is generally related to economy, religion, social and biological that the societies follow in feeding practice of their children. Similar findings were observed in different surveys (Clark, 1981; Field et al, 1981) (Table 4.2.1).

When comparison is made by Zone, a negative and significant association for sex of the child and stunting is observed for each Zone. The risk of being stunted for female children in Misrak Gojjam and Semen Wello Zones is lower by 10.70 percent and 1.2 percent, respectively as compared with male children in each Zone (Table 4.2.2).

#### ***4.2.9 Stunting and Sex of Head of The Household***

It is assumed that, if the head of the household is female then the prevalence of malnutrition will be low. This is because biologically and socially children are more attached with mothers (females) than males. In conformity with this assumption in all univariate, bivariate and multivariate analysis we have found lower prevalence of malnutrition for female headed household. From Table 4.2.1, we can observe that sex of head of the household and stunting are negatively and insignificantly associated. The logistic regression out put, revealed that the risk of being malnourished for children who were from female headed household was lower by 8.40 percent than their counter parts. Yohanes 1993 have also found similar results for war-torn society in Ethiopia.

When observation is made for each and both Zones together, sex of head of the household had negative and insignificant association with stunting. But when we compare the risk, Misrak Gojjam Zone children who are from female headed household had more lower chance of being stunted (12.00%) than that of Semen Wello Zone children (6.5 %) (Table 4.2.2).

#### *4.2.10 Stunting and Vaccination*

With regard to Vaccination, the general expectation is, those children who had been vaccinated, have lower prevalence of chronic malnutrition. The logistic regression output after controlling all the confounding factors revealed that, children who had not been vaccinated have higher chance of being stunted than with the vaccinated ones (Table 4.2.1). From the table, the risk of being stunted for those children who were not vaccinated is higher by 2.24 percent when compared with those children who were vaccinated.

When comparison is made by each Zone, a similar trend for Semen Wello Zone as both Zones together is observed. In Semen Wello Zone, those children who were not vaccinated have 2.98 percent higher chance of being malnourished than children who were vaccinated. Similarly, in Misrak Gojjam Zone, the risk of being malnourished for children who were not vaccinated is higher by 9.3 percent as compared with the vaccinated children. (Table 4.2.2). Similar result was observed by Rutestin (1996, Tekle, Gugsu, 1997).

#### *4.2.11 Stunting and Type of Source of Water*

As hypothesized, a positive and highly significant relationship observed between type of source of water and stunting (Table 4.2.1). After controlling all other confounding factors the risk of being stunted for children of households who obtained their water supply from unsafe source was 49.79 percent higher than those children who have been come from households who used water supply from safe source. This is because without an adequate supply of good quality water, a household personal, domestic and food hygiene are compromised and the risk of pathogen contamination (and these diarrhea diseases) increases affects indirectly the nutritional status of children. Similarly a positive relationship between type of source of water and

stunting was also found by Negussie, 1994 for Bale region.

When observation is made for each Zone, a positive and highly significant association observed between chronic malnutrition and type of source of water for Misrak Gojjam Zone. Those children who have come from households which used unsafe water have 50.91 percent higher than with those who were from households who used safe water (Table 4.2.2 ). For Semen Wello Zone, a positive association was observed between chronic malnutrition and source of drinking water. The chance of being stunted was higher by 15.51 percent for those children who are from households who used unsafe water than children who have come from households which used safe water. Generally, more risk of malnutrition was observed in Misrak Gojjam Zone than Semen Wello Zone.

## CHAPTER FIVE

### 5. SUMMARY RECOMMENDATIONS AND CONCLUSIONS

#### 5.1. Summary

Malnutrition is one of the most important health and welfare problems among infants and young children in Ethiopia, resulting in serious health and economic consequences for both the individual and nation. The 1992 Rural Nutrition Survey and the 1998 National Nutrition Survey conducted by Central Statistical Authority (CSA), showed that the level of both acute and chronic malnutrition of the country is very high. This high prevalence of malnutrition showed variations among regions and among administrative Zones within the regions. According to the prevalence of malnutrition a considerable variation in the prevalence was observed among the administrative Zones of the region. In order to formulate plausible policy and tackle the existing problems, detailed study on the determinants of the nutritional status of children among the administrative Zones is very important. For the purpose, Misrak Gojjam Zone and Semen Wello Zone, two of the eleven Zones found in the Amhara region have been selected for this study because of their high level of malnutrition in the previous surveys.

Literature reviews on the topic showed that various socioeconomic, demographic, child care and environmental factors affect the high prevalence of malnutrition. The conceptual framework for the study was built on these premises. The data, which have been used for the analysis of this study, have been checked for its quality using different accepted methods before the start of analysis. Height Heaping Ratio (HHR) method, Weight Heaping Ratio (WHR) method, Age Heaping Measurement (AHM) method and Improbable Measurements

(Flagging of the Z-Scores) are among the different methods used to check the quality of the data. In all methods, the data was found to be of reasonably good quality, though some minor problems were observed.

All the Univariate, Bivariate and Multivariate methods of analysis were employed for the analysis of this study. This study revealed that in all the three indicators (Stunting, Wasting and Underweight) the levels of malnutrition were found to be very high for both Misrak Gojjam and Semen Wello Zones.

According to this study, 67.0 percent and 68.9 percent of children aged 3-59 months were found to suffer long-term malnutrition (Stunting) for Misrak Gojjam and Semen Wello Zones, respectively. The levels of acute malnutrition (Wasting) were 8.9 for Misrak Gojjam Zone and 9.0 for Semen Wello Zone. In addition, the level of general malnutrition (underweight) were also found to be 58.3 and 57.5 for Misrak Gojjam Zone and Semen Wello Zone respectively.

The levels of long term malnutrition found from this study have shown increment for Semen Wello Zone and a decrement for Misrak Gojjam Zone when compared with the previous survey in which the prevalence was 68.6 and 68.9 for Semen Wello and Misrak Gojjam Zone, respectively. In both surveys, however, the levels of chronic malnutrition is higher for these Zones as compared to the country total level (52.9 percent as of 1998 CSA report).

When we compare the levels of this study of the Zones with other neighboring countries, the levels are very high. Except Ethiopia, the levels of chronic malnutrition range from 22 percent to 38 percent in these countries (UNICEF, 1998,). Therefore, the prevalence of chronic malnutrition for these Zones are among the highest and still the existing problem which needs

urgent attention to overcome and improve it.

Assessments of Zonal variation with respect to chronic malnutrition and its covariates have been made. In all the univariate, bivariate and multivariate results all variables (except vaccination) have shown a consistent pattern. In the Univariate Result the sampled households from both Misrak Gojjam and Semen Wello Zones have been assessed according to their background characteristics. For each Zone, the highest proportion of sampled children was observed for the birth order 4 and above, and slightly higher percentage was noted for Misrak Gojjam Zone (49.5%) than Semen Wello Zone (46.4%).

Among the sampled children more than 85 percent are above age one in each Zone, indicating that the effect of supplementary food is significant for the nutritional status. The highest proportion from Misrak Gojjam (24.9 %) is observed for age group 12-23 while for Semen Wello Zone 2 and above other number of under five children living in the household have higher percentage (56.5) than that of Misrak Gojjam Zone (44.9) which contributed for the variation in the level of malnutrition between these Zones.

From the sampled children, diarrhea is much more common (almost 4.0 times more) for Semen Wello Zone (79.1 %) than that of Misrak Gojjam Zone (74.2 %), which might have brought a significant variation in the level of acute malnutrition (Wasting ) and also chronic malnutrition (Stunting ).

Among the sampled households more than 50 percent have annual income of 0-700 Birr in each Zone which indicates that the people who live there are very poor. This very low income

might have strong implication on the level of the nutritional status of each Zone.

The proportion of mothers who reported the growth performance of their children was 'good' is more than two times higher for Misrak Gojjam Zone (69.8%) and almost three times higher for Semen Wello Zone (74.1%) as compared to those who reported 'poor'. This shows that either the mothers have not the know-how about the growth of their children or even though the know-how existed, they have a limited resources, when we see the high prevalence of malnutrition.

More proportion of male children was observed for both Misrak Gojjam (54.3%) and Semen Wello (50.8%) Zones. About 90 percent of the head of the households were males for each Zone, indicating that the chance of children to be malnourished is higher. Among the sampled children who have obtained the chance of vaccination are below 50 percent in each Zone. This shows that, the existence of high risk for the exposure of different types of infectious diseases. A higher percentage of vaccinated children were observed for Semen Wello Zone (46.7) than that of Misrak Gojjam Zone (42.7).

Unsafe sources of water for each Zone are much more common. This indicated that children of Misrak Gojjam and Semen Wello Zones are at a greater risk for various types of diseases, particularly diarrhea. In Semen Wello Zone (94.2%) had higher proportion than that of Misrak Gojjam Zone (79.4%). This difference have strong contribution for the observed different levels of malnutrition in the areas.

In the Bivariate Result, using the cross tabulations the descriptive analysis has revealed that, higher birth order, diarrhea, large household size, low household income, illiteracy of mothers,

male children, households headed by males, vaccination and unsafe water have the highest percentage of chronic malnutrition.

According to the Multivariate Analysis, birth order of children, child's age, household size, household income, mother's education and sex of the child had shown a statistically significant association with chronic malnutrition for Semen Wello Zone. For Misrak Gojjam Zone, child's age, household income, mother's opinion, sex of the child and source of drinking water had shown a statistically significant association with chronic malnutrition (Table 4.2.2). On the other hand, for both Zones together, birth order of children, child's age, household size, household income, mother's opinion, sex of the child and source of drinking water are found to have a significant association with chronic malnutrition (Table 4.2.1). For Misrak Gojjam Zone, the risk of chronic malnutrition was found to be higher for birth order 2-3 (8.59%) than that of Semen Wello Zone (1.71%).

Child's age was found to be statistically significant for both Misrak Gojjam and Semen Wello Zones, Except for the age group 12-23 both Zones, a positive association with chronic malnutrition was observed. This shows that children's nutritional status is more sensitive for some factors at specific age and appropriate care should be given in feeding practices. Household size has shown a positive and significant association with chronic malnutrition for Semen Wello Zone. That is for each additional member of a household chronic malnutrition may increase by about 5.12 percent. For Misrak Gojjam Zone, a positive association between household size and chronic malnutrition was observed that is for every additional member of a household malnutrition increases by 0.11 percent.

Household income has shown a negative association with chronic malnutrition for each Zone, this indicated improvements in household income might help for the decrement of malnutrition in the areas. Mother's opinion has shown a negative and significant association for Misrak Gojjam Zone, while a negative and insignificant association for Semen Wello Zone. Regarding to Mothr's Education, it has shown a significant associations in both Zones togethr and Semen Wello Zone.

The result also revealed the existence of positive and significant association between sex of the child and chronic malnutrition for Misrak Gojjam Zone and Semen Wello Zone. This might suggest that sex preference practiced is more in Misrak Gojjam Zone than Semen Wello Zone. For each Zone, sex of the head and chronic malnutrition have a negative association. This might have an implication, that female-headed household has a lower chance for chronic malnutrition of children than male headed household. Vaccination has shown a positive association with chronic malnutrition for Semen Wello Zone, while a negative association for Misrak Gojjam Zone. This shows us that, vaccination has more impact in the reduction of malnutrition for Semen Wello Zone than Misrak Gojjam Zone.

Statistically high significant and positive association between source of water and chronic malnutrition was observed for Misrak Gojjam Zone and both Zones together, on the other hand insignificant association was observed for Semen Wello Zone. This may lead us to say, contaminated water has strong implication for the increment of malnutrition in (through diarrhea) Misrak Gojjam Zone than Semen Wello Zone.

A dummy variable of current Zonal residence which was introduced in to the model as a proxy

for all other variables which were not included in the study model but are expected to bring variations in the Zones revealed that the risk of being chronically malnourished for children are higher by 1.80 percent for Semen Wello as compared with that of Misrak Gojjam Zone.

## **5.2. Recommendations and Conclusions**

The study revealed that the underlying causes of chronic malnutrition in the areas are multifaceted, and to improve nutrition sustainably simultaneous action may be required in many ways.

The following are the specific recommendations:

- (1) The study revealed that households having lower income have higher level of chronic malnutrition. Since the sampled households belong to the rural areas, modernizing the primitive agricultural system for households having the lowest income and owning some agricultural land, should be provided with improved seeds, fertilizers and irrigation facilities such as loan for digging wells and supply of electricity for irrigation on subsidized basis by the government and different agencies. These measures would help the poor households to produce more food grains and hence have an increased income.
- (2) Since the study has shown that diarrhea and source of water aggravate chronic malnutrition, efforts should be made in improving access to clean water, improving environmental sanitation and personal hygiene to prevent exposure to diarrhea pathogens, encourage breastfeeding exclusively up to the recommended age and improving diarrhea prevention program.

- (3) We have seen from the study that feeding practices have strong impact on the high prevalence of chronic malnutrition. This may happen because of different traditions (beliefs), that is different treatment might be given to the male and female children with regard to feeding practices. Therefore, introduction of education about proper feeding practices to all children is crucial.
- (4) The study revealed that, high birth order and large household size (more number of children) are positively and significantly associated with chronic malnutrition. Thus it is better to have nuclear household system rather than joint or extended joint household as it is difficult to provide attention to all children with regard to nutritional status and childcare. This could be achieved through family planning programs practicing contraceptive methods for spacing and limiting the number of children.
- (5) Child's age has shown a strong positive and significant association with chronic malnutrition. Thus, efforts should be made in communication through different programs, such as health and nutrition education, the importance of feeding breast milk exclusively up to 4-6 months and thereafter the introducing of other supplementary foods which are rich in their nutrients should form the part of the nutritional policy.
- (6) The study revealed that mother's education and empowerment of women (as being head of the household to make decisions) were important in reducing chronic malnutrition. Hence, an improvement in education policies, which favors women by the national and state government, is important as females are best heads.

## **General Recommendations**

In addition to the above specific recommendations, the study would recommend the following two other general recommendations:

- 1) Although, mother's nutritional status is not included in the survey and hence in this study, it is clearly known that this in turn affects children nutritional status (since child's malnutrition starts in the womb), therefore improving nutritional status of mothers is very important for the normal and balanced growth performance of children. In addition expanding the antenatal care program for the Zones will contribute its part for the reduction of the high level of chronic malnutrition.
  
- 2) With respect to food security, by making food production more accessible to the poor using different approaches such as promotion of small-scale community based agriculture, it is possible to minimize the high level of chronic malnutrition in the Zones. Besides, implementing rural based development programs in the areas may bring chance for the households to have additional incomes. Finally, more comprehensive studies for the Zones concerning the nutritional status of children are recommended.

## **Appendix 1**

### **Categorization of Variables Used in The Study**

The dependent variable for this study is chronic malnutrition (stunting). The following variables have been used as explanatory variables for the analysis:

#### **Socioeconomic Variables**

##### **Household Income**

- (1) 0-700 Birr - Poor status
- (2) 701-1500 Birr - Medium status
- (3) Above 1500 Birr - High status

##### **Mother's Opinion about growth performance of children**

- (1) Good
- (2) Poor

##### **Mother's Education**

- (1) Primary and above - educated
- (2) Illiterate- Not educated

#### **Demographic Variables**

##### **Child's Age**

- (1) 3-11 months
- (2) 12-23 months
- (3) 24-35 months
- (4) 36-47 months
- (5) 48-59 months

**Sex of The Child**

- (1) Male
- (2) Female

**Household Size**

- (1) 1-3 members
- (2) 4-7 members
- (3) 8 and above members

**Sex of The Head of The Household**

- (1) Male
- (2) Female

**Birth Order of children**

- (1) 1
- (2) 2-3
- (3) 4 and above

**Child Care and Environmental****Vaccination**

- (1) Not Vaccinated ( if he/ she didn't take any or one)
- (2) Vaccinated ( if he/ she took two or more)

**Source of Water**

- (1) Unsafe ( if the household used source of drinking water from river, lake, or unprotected well)
- (2) Safe ( if the household used source of water from tap ( private or public, and protected well

## Appendix 2

Table 1.: Diagnosis of Multicollinearity, for Each Zone and Both Zones together

Back Ground Variables	VIF		
	Misrak Gojjam	Semen Wello	Both Zones
Birth Order	1.211	1.308	1.254
Child's Age	1.512	1.584	1.311
Diarrhea	1.066	1.068	1.063
Household Size	1.012	1.597	1.508
Household Income	1.446	1.049	1.022
Mother's Education	1.082	1.063	1.062
Mother's Opinion	1.042	1.050	1.053
Sex of the Child	1.020	1.018	1.008
Sex of the Head of Household	1.158	1.080	1.090
Vaccination	1.027	1.027	1.014
Source of Water	1.065	1.026	1.024
<p>NB. All the values of Maximum Variance Inflation Factor, VIF ( Collinarity ), are less than 5 which shows no problem of collinarity.</p> <p>Note: Acceptable values of maximum variance inflation factor ( VIF) are not exceeding 5.</p>			

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

### Appendix 3

Table 3.: Levels of Malnutrition Using Two or More Indicators for Each Zone and Both Zones Together, 1998.

<b>ZONE</b>	<b>Both Stunted and Under Weight</b>	<b>Both Wasted and Under weight</b>	<b>Both Stunted and Wasted</b>	<b>All, Stunted Wasted and Underweight</b>
<b>Misrak Gojjam</b>	49.5	8.3	6.8	6.3
<b>Semen Wello</b>	46.4	10.4	7.8	5.8
<b>Both Zones</b>	47.8	9.4	7.4	6.1

Source: Computed by the Author from the 1998 Health and Nutrition Survey.

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## DECLARATION

I, undersigned declare that this thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis been duly acknowledged.

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