CHILD MALNUTRITION IN YEMEN: THE ROLE OF FEMALE EDUCATION

Bilguis M. Al-Eryani
Yemen

2nd Masters in International Health (MIH)
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KIT (Royal Tropical Institute)
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A thesis submitted in partial fulfillment of the requirement for the degree of

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by

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“We are guilty of many errors and many faults but our worst crime is abandoning the children, neglecting the foundation of life.
Many of the things we need can wait.
The child cannot.
Right now is the time his bones are being formed, his blood is being made and his senses are being developed.
To him we cannot answer “Tomorrow”.
His name is “Today”.

Gabriela Mistral, 1948

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Summary

Child malnutrition in Yemen is a major public health problem, showing a prevalence of 53% for stunting, 46% for underweight and 13% for wasting among children under five. According to the WHO classification, the levels for stunting and underweight are considered very high severity and for wasting it is of high severity in Yemen.

The objective of this thesis is to analyze the role of female education in development of malnutrition among children under five in Yemen in order to provide policy makers with recommendations that help in improving child nutrition in Yemen.

The study question is answered by literature review and the use of the Demographic and Maternal and Child Survey (DMCHS) of 1997. The thesis was guided by the extended model of care framework adapted from the United Nations Children's Fund (UNICEF) conceptual framework. The framework provides a connection between female education and certain care practices important for a healthy well nourished child. The care practices analyzed are infant feeding, hygiene practices and health seeking behavior. The role of education to female autonomy as a resource for care was also analyzed. Various proxies were used for the care behaviors as well as for autonomy. In addition several interventions in developing countries promoting female literacy, nutritional education and school enrollment were also analyzed for possible recommendations in Yemen.

The relationship of mothers education to child stunting showed that children of mothers completing secondary education had a 3 times reduction in the prevalence of stunting than children of illiterate mothers. Female education as a resource of care was analyzed in Yemen. Results of the analysis show that for breast feeding, mothers education is associated with longer exclusive breastfeeding (1.2 months for secondary schooling complete mothers compared to 0.5 months for illiterate mothers) while for breastfeeding in general it tends to be shorter for mothers completing primary or higher schooling than for illiterate mothers (14 months for primary or higher and 18 months for illiterate mothers). Complementary feeding analysis reveals that more children of mothers completing secondary schooling are given foods in addition to breast milk than are children of illiterate mothers (68% and 57% children of secondary complete and illiterate mothers respectively).
Analysis of hygiene proxies, show that children of mothers completing secondary schooling have a 1.5 times reduction in the prevalence of all diarrheas compared to children of illiterate mothers (19% prevalence for children of secondary complete compared to 28% for children of illiterate mothers). Children of illiterate mothers are also more than 3 times (7.5%) as likely to get bloody diarrhea as children of secondary school complete mothers (2.2%).
For health seeking behavior proxies, mothers completing secondary schooling were 7 times more likely to have received 4 or more antenatal care visits (ANC) (only 8% of illiterate mothers compared to 57% of mothers completing secondary school) and about 5 times more likely to have been vaccinated with 2 doses of the toxoid vaccine (only 7% of illiterate mothers compared to 34% of mothers with secondary schooling). Mothers completing secondary school were also three times more likely to vaccinate their children (71% compare to 24% children of illiterate mothers) and almost twice as likely to seek help from a health facility or provider in case of child illness (59% and 30% for secondary complete and illiterate mothers respectively) among others.
Use of modern contraceptives as the proxy for autonomy, shows that mothers with secondary schooling completed were about four times more likely to use these methods than were illiterate mothers (98% of secondary complete mothers use modern contraceptives compared to 76% of illiterate mothers). The increased use of modern contraceptives by mothers

completing secondary school contributed to their lower fertility rate of 3.1 as compared to a 6.9 fertility rate of illiterate mothers.
The following recommendations were therefore directed at increasing female education in Yemen: strengthening or implementing female literacy programs in the rural parts of Yemen; adding a nutritional education and proper child care practices component to all literacy programs; promoting communication for behavioral change using the hearth model in the rural areas of Yemen; increasing the girl's enrollment in schools through school fee waiving, building local community schools for girls and training more female teachers; Providing scholarship schemes and school feeding programs with take home rations in return for girls schooling, targeting governorates with the highest gender disparities as in Hajja.

Key words: malnutrition, stunting, underweight, wasting, children, female education, Yemen, developing countries, nutrition programs, school feeding.

LIST OF ABBREVIATIONS

ACC/SCN	Administrative Committee on Coordination, Sub-Committee on Nutrition (of the United Nations) now SCN (Standing Committee on Nutrition)
ANC	Anti-natal Care
ARI	Acute Respiratory Infection
BCG	Bacille Calmette-Guérin
CSO	Central Statistical Organization
DALYS	Disability-Adjusted Life Years
DHS	Demographic and Health Survey
DMCHS	Demographic and Maternal and Child Health Survey
DPT	Diphtheria Pertussis and Tetanus
ESCWA	Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agricultural Organization Statistical Databases
FHS	Family Health Survey
FIVIMS	Food Insecurity and Vulnerability Information and Mapping Systems
GDP	Gross Domestic Product
HA	Height for Age
HBS	Household Budget Survey
IFPRI	International Food Policy Research Institute
IRIN	Integrated Regional Information Network
LBW	Low Birth Weight
MDG	Millennium Development Goals
MENA	Middle East and North Africa
MUAC	Mid Upper Arm Circumference
MPIC	Ministry of Planning and International Cooperation
MOPHP	Ministry of Public Health and Population
MoE	Ministry of Education
NGOs	Non Governmental Organizations
ORS	Oral Rehydration Salts
PEM	Protein Energy Malnutrition
PPP	Purchasing Power Parity
SD	Standard Deviation
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund

UNESCO	United Nations Education, Social and Cultural Organization
WA	Weight for Age
WH	Weight for Height
WHO	World Health Organization

CHAPTER 1: Background Information on Yemen

1.1 Geography and Climate

The Republic of Yemen is located in the Southern part of the Arabian Peninsula and spreads over an area of 536,869 Km2. It is bordered by Saudi Arabia to the north, Oman to the East, the Arabian Sea and the Gulf of Aden to the South and the Red Sea to the West separating it from the African continent (See Annex 1).
The natural topography of the country can be divided into five major areas: the mountainous area, the coastal area, the plateau area, the desert (Al-Ruba Al-Khali) area, and the 112 Yemeni islands in the red sea and Arabian Sea. In the mountains and highlands, altitudes range from 500 to 3,600 meters. Yemen's climate is predominantly semi-arid to arid. There are two rainy seasons, from February to April and from July to August. Rainfalls are much higher in the mountainous and highlands than on the coastal plains.

1.2 Population

According to the Yemen Central Statistical Organization (CSO) the population of Yemen is about 19.7 million, with a growth rate of about 3% (CSO 2004). The population is projected to reach 28.5 million by the year 2015 (UNDP 2005). The population density, in general, is around 37/km2 in 2003. The average household size is about 7.1(CSO 2004)**.**

1.3 Socio-Economic Conditions

1.3.1 Religion and language

Almost all Yemeni citizens are Muslims. There is also a small number of Yemeni Jews. The constitution provides for freedom of religion but Islam is the state religion and the Sharia (Islamic) law is the basis of all legislations.
Arabic is the official language. English is taught at schools from the 7th grade but proficiency in English is mainly among those who go to private schools where it is the main language of teaching.

1.3.2 Education

Education, being one of the most important indicators of socio-economic development as well as a basic human right, has received attention from the state since the revolution in 1962. At the time of the revolution there was not one secondary school in the Yemen, with the exception of Aden city which was at that time a British colony.
The Ministry of Education (MoE) is responsible for developing and implementing the government's education policy, teacher hiring and training, supervision, curriculum development, textbook publishing with distribution and the allocation of human and financial resources. Although there are management structures at government and district levels, education sector management is highly centralized.
Education is not free as it includes a tuition fee of about $3 per school year. Money is also needed for other school items, such as school uniforms which can cost about $8. Although these costs may seem marginal, they are a heavy burden on the poor and girls will bear the brunt if the family can not afford it.

The educational system consists of primary and secondary schooling. Primary schooling involves 9 years of school for ages 6-15 years and it is compulsory while secondary education is only 3 years[1]. Despite some improvements in education for women, Yemen's educational gender gaps are still among the widest in the Middle East and North African region (MENA) (UNESCO 2002) .
Almost 80% of boys but only 40% of girls between the ages of 6 and 15 are in school. Table 1 show that the percentage of females to total students in primary school (38.7%) is much lower than for males (61.3%). Moreover this difference is further widened when looking at the secondary school figures where the percentage of girls decreases to 30.3% of the student's population due to the high dropout of girls (Ministry of Education, 2006).
According to the 2004 Yemen CSO, the number of public schools was 10,565 for primary and 288 for secondary schools (see Table1). Although the secondary school students makeup only one sixth of the number of primary students, the average number of students per teacher in secondary school is about 92 in comparison to 40 for primary schools, indicating a very high shortage of teachers more severe for secondary schools. The consequences of the shortage of teachers and schools will lead to overcrowded classrooms with shortage of desks and chairs as well as hiring of inadequately trained teachers, which is commonly seen in Yemen public schools. Another problem facing the educational sector is the lack of adequate monitoring of schools by the MoE especially in the rural areas (ESCWA[2] 2001).

Table 1: Education Indicators for Yemen in 2004.

ITEM	Primary school	Secondary school
Number of public school	10,565	288
Percentage of males to total students	61.3%	69.7%
Percentage of females to total students	38.7%	30.3%
Average students per teacher	40.3	92.2

Source: Yemen Central Statistical Organization, 2004

In order to counteract these deficiencies in schooling, Yemen established the National Basic Education Development Strategy in 2003, which is considered the national programme for "Education for All". The government also increased it's spending on education from about 4.5% of its Gross Domestic Product (GDP) in 1995 to 9.5% of GDP in 2003.

1.3.3 Government Structure

[1] Prior to unification of South and North Yemen, the educational system was divided into primary, consisting of 6 years; preparatory consisting of 3 years; and secondary consisting of 3 years. After unification primary and preparatory were combined to form primary.
[2] ESCWA is Economic and Social Commission for Western Asia

Yemen, which was divided into a northern and southern part unified on 22 May 1990 to become the Republic of Yemen. Yemen is an emerging democracy. Since 1990 it had three parliamentarian elections, two presidential elections, and local council's election. Administratively Yemen is divided into 20 Governorates and one municipality of the capital city Sana'a. Though a decentralization process was started in 2001, the central government still presides over all important matters related to major divisions such as health and education.

1.3.4 Economy

Yemen is one of the poorest and least developed countries in the region. It ranks at 151 from 177 in the UNDP human development index (UNDP 2005). The Gross Domestic Product (GDP) per capita (PPP US $)[3] is $889. The percentage of the population with an income of less than $1 per day (according to PPP) is about 10.7% (12.4% of rural people and 5.2% of urban people). The percentage rises steeply to 47.7 %(50.2% of rural people and 36.4% of urban people), when we consider those whose income is below $2 dollars per day (according to PPP). About 31% of the populations are without sustainable access to an improved water source (UNDP 2005).
Industry contributes to 47.2% of its GDP, with the main industries being oil production and refining, cement production, food processing and leather products.
Services contribute to 39.3% of GDP. Agriculture contributes to only 13.5% of GDP although about 75% of the population depends on agriculture as a main source of livelihood. The main agricultural products are fruits, vegetables, grains, live stock, poultry, and fish.
The government revenues are 37.7% of GDP, and over 68% comes from oil, 24% from taxes, and the remainder from other sources.
Yemen faced several crises in the early nineties which strained its economy. In 1990-1 there was the gulf war leading to the forced return of around 800,000 Yemenis from Saudi Arabia and Gulf States and the immediate interruption of their remittances. In 1994 a war broke out in Yemen between those for unification of Yemen and those against it. The war lasted around 2 months and ended in July. As a result, these crises lead to inflation, increasing poverty, growing unemployment and increasing public debt. In 1995, the government launched an economic reform program.

1.4 Health system

1.4.1 The health sector in Yemen

The health system in Yemen adopted the primary health care approach in the year of the Alma Ata conference in 1978. The Ministry of Public Health and Population (MoPHP) operates a system of health care facilities, delivering primary health care in health centers and health units at the village and district levels, secondary care at rural (district) and governorate hospitals, and tertiary care at referral hospitals in Sana'a and Aden. The catchment area for the health units and health centers is about 3,000 and 10,000 people respectively. The health delivery system gradually increased in geographic coverage[4] from 10% in 1970 to about 50% in 2000.[5] (MoPHP 2000).

[3] PPP: Purchasing Power Parity in U.S dollars.
[4] Defined as the proportion of the total population within a fixed distance of a health facility

[5]This measures only the presence of health facilities and not the service provided by the health facility, which if measured would be much lower

Although the accessibility to health facilities has improved, the health system has suffered from many structural and service delivery problems which include poor quality of service, low staff morale, lack of essential drugs, inadequate levels of running costs, low efficiency, underutilization, leakage of resources out of the system into private hands, lack of equity in distribution of facilities and manpower (MoPHP, 2000) .
The distribution of health facilities is mainly concentrated in urban centers and developed governorates leading to 80% health coverage in urban areas in comparison to only 25% coverage in the rural areas. There is a shortage of health workers with 50% of physicians situated in Sana'a and Aden cities[6] (Ministry of Planning and International Cooperation (MPIC), CSO, 2004). These problems may have contributed to Yemen having the lowest health indicators in the region (See section 1.4.2).
Since the reunification of Yemen, the government and donors have realized that free health for all is not affordable or sustainable due to the high population growth rate and poor economy. In order to mitigate all these problems, health sector reform strategy was introduced in 1998 which included, decentralization plans, redefinition of the role of the public sector, an essential drugs policy and encouragement of responsible participation by the private sector and NGOs, as some of its main strategies (MoPHP 2000).
This led to a rapid increase in number of private health facilities from 2002 (see Annex 2 for number of public and private health facilities). But unfortunately they are not all properly monitored or regulated and overlap with governmental health facilities (National Health Accounts, 2006).
The other changes that occurred were cost sharing and establishing a district health system in some areas. From observation, it seems that cost sharing has only resulted in higher costs for patients with no improvement in the quality or accessibility of health care.
Based upon a review of the health sector reform progress the Minister of Public Health and Population stated that much work is left to be done and thus focus will be placed on primary health care, curative services, health planning and development and population (MoPHP 2004).
Government spending on health shows that, about 117.3 billion Yemeni Riyals (YR) (US$ 639 million)[7] were spent on health which amounts to 4.9% of total government spending. The total health spending comprised about 5.6% of GDP. The household out–of–pocket spending on health accounted for 60% of the total while the government accounted for 32% and the donors accounted for the remaining 8% of the total amount spent on health (National Health Accounts 2003).

Growth monitoring of young infants, in Yemen, takes place mainly in the health centers during routine immunization (which end at nine months of age) with measurement of weight recorded in a growth chart. There is no outreach programme for growth monitoring. Hence, children are not weighed after nine months unless they seek medical care in a hospital or at a private facility. Usually height is not routinely measured at the health facilities or at hospitals.
Yemen still faces major challenges to improving the health status of its population, which go beyond the health delivery network. Poverty, low participation in education especially among girls, and high illiteracy are major contributing factors to poor health as are limited access to potable water and proper sanitation. Only 55% of the rural population has access to safe drinking water and only 14% of the rural population has access to adequate sanitation. (Richardson G et al., 2000).

1.4.2 Health situation in Yemen

[6] The ratio of health workers to population is 1 physician for 4,650 people, 1 nurse for 2,913 people and only 1 trained midwife for 14,465 women.
[7] The exchange rate in 2003 was 1 US dollar for 184 Yemeni Riyals.

Yemen is at an early stage of the epidemiological transition, with morbidity and mortality from communicable diseases dominating those from non communicable diseases. The most prevalent diseases include diarrheal diseases, malnutrition, acute respiratory infections and malaria (Richardson G et al., 2000).
Although the infant mortality rate has improved from 1980 when it was 141 per 1,000 live births it is still one of the highest in the MENA region at 85 per 1,000 live births coming second only to Iraq (World Bank estimates 1999) (see Annex 3). The under five mortality rate is also high at 121 deaths per 1,000 live births but has shown a marked improvement since the 1960's when it was at the rate of 340 per 1,000 live births (UNICEF 2000). Diarrheal diseases and acute respiratory infections compounded by malnutrition are the leading causes of childhood morbidity and mortality in Yemen.
Maternal mortality rate is very high in Yemen at 1,400, but estimates vary widely with the officially accepted figure at 351 maternal deaths per 100,000 live births (DMCHS 1997). This high maternal mortality can be explained by inadequate pre-, peri-, and postnatal care, by the high total fertility rate (6.5), early pregnancy and low rates of modern contraceptive use (only 13% of married women use contraception). Maternal mortality rate and fertility rate in Yemen are the highest in the MENA region (see Annex 3).
In 1997 the life expectancy was around 53.5 years which was one of the lowest for the MENA region. Although the life expectancy at birth has increased to 62.9 years, this is still below the average of 71 years in the MENA region (CSO 2004).

Yemen is far from achieving universal coverage in child immunization,[8] only about 20.9% of children 0-11 months are vaccinated with all the vaccines [9] and this percentage reaches 28% for 12-23 months old children (56% are from urban areas versus 20% from rural areas) while 12% have not received any vaccination. Coverage of 54% is seen for both BCG[10] and the first dose of DPT (DPT1)[11] for children age 12-23 months while coverage for the third dose of oral polio is 46% and for measles it is 43% (DMCHS 1997). However, the WHO-UNICEF estimates for vaccine coverage in 2004 show an increase from the 1997 figures for BCG, DPT1, oral Pol3[12] and measles coverage to 63%, 92%,78% and 76% respectively in 2004 (see Annex 4).

CHAPTER 2: General introduction To Childhood Malnutrition

This chapter will introduce malnutrition in general with emphasis on childhood malnutrition world wide, its magnitude, causes and its effects and consequences

2.1 Childhood Malnutrition

[8]The children receive their first immunization in the first month of birth with the B.C.G and first dose of oral polio vaccine and the first of three doses of Hepatitis B vaccine, followed one month later by DPT and oral polio given for three doses one month apart and the second dose of Hepatitis B and at 9 months the measles vaccine is given with the third dose of Hepatitis B.

[9] Vaccines include: BCG, measles and 3 doses of DPT and 3 doses of oral polio.
[10] BCG: Bacille Calmette-Guérin
[11]DPT: Diphteria, Pertusis and Tetanus vaccine
[12] Pol 3 : Third dose of oral Poliomyelitis vaccine

The World Health Organization (WHO) **defines** malnutrition as a general term that refers to a number of diseases, each with a specific cause related to one or more nutrients (for example, protein, iodine or iron) and each characterized by a cellular imbalance between the supply of nutrient and energy and the body's demand for them to ensure growth, maintenance and specific functions. This may lead to both under nutrition and over nutrition. The two main constituents of under nutrition are Protein Energy malnutrition (PEM) and Micronutrient deficiency. In the context of this thesis, deficiency of nutrients in children below five years of age will hereafter be referred to as childhood malnutrition .
The importance of nutrition lies in the fact that it is a basic human right of the child, according to the convention on the rights of the child, article 24 (United Nations High Commissioner of Human Rights, UNHCHR, 1989). Nutrition is also an important component to the attainment of the Millennium Development Goals (See Annex 5).

2.2 Extent of Childhood Malnutrition

In developing countries, the extent of PEM is estimated using anthropometric data to form the 3 main anthropometric indicators: height-for-age (HA), weight-for-age (WA) and weight-for-height (WH). If these measurements fall below an anthropometric cutoff of 2 standard deviations of the median HA, WA, WH of the National Center for Health Statistics/WHO international reference population, this is referred to as stunting, underweight and wasting respectively. If they fall below 3 standard deviations then this is referred to as severe stunting, underweight and wasting respectively.[13]
Stunting results from long-term cumulative effect of inadequate food, health or care and reflects on chronic nutrition deficiency. Wasting results from a recent or continuing current severe weight loss and reflects acute malnutrition. On the other hand, underweight may reflect, stunting and/or wasting and can not distinguish between acute and chronic malnutrition.
Malnutrition is a global epidemic and more than a quarter (around 146 million) of children under five years of age in developing countries are underweight (UNICEF 2006). In the list of main risk factors contributing to the global burden of disease, malnutrition was top, contributing 15.9% of total DALYS (Murray CJL 1996).[14]
And as of 2000 it is estimated that around 162 million children (about 1 in 3 children world wide) are stunted (ACC/SCN, 2003). The highest prevalence is seen in South Asia and Sub-Saharan Africa (See Annex 6). Behrman et al., 2004 and Beaton et al., 1990, have argued that stunting can be considered a proxy for multifaceted deprivations in a population.

Low birth weight (LBW), which is an important indicator for fetal/intrauterine malnutrition, can be a strong predictor of subsequent growth and well being. de Onis et al.(1997), show that the level of infants born with low birth weight is 23% in the least developed countries

[13] The assessment of nutritional status is based on the concept that in a well nourished population the distributions of children's height and weight, for a given age, will approximate a normal distribution. Meaning that about 68% of children will have a weight within 1 standard deviation (S.D.) of the mean for children of that age. About 14% of the children will be between 1 and 2 S.D. above the mean (overweight for their age), and another 14% will be between 1 and 2 S.D. below the mean (underweight for their age). This leaves 2 percent of children on either side of the normal distribution, 2% of children > 2 S.D. will be expected to be very overweight for their age, and 2% of children <–2 S.D. will be very underweight for their age. The normal distribution used to determine the distribution of children based on their nutritional status is the International Reference as defined by the National Center for Health Statistics (NCHS) and the Centers for Disease Control and endorsed by the World Health Organization (Ritu Chhabraa and Claudia Rokx 2004)

[14] Disability adjusted life year (DALY) expresses years of life lost due to premature death and years lived with a disability of a specified severity and duration. One DALY is 1 year of healthy life lost.

versus 7% in developed countries with the primary reason being intrauterine growth retardation (de Onis et al 1997).

Although data for micronutrient deficiencies in developing countries is far from perfect, the WHO estimates that approximately 2 billion individuals worldwide are iron deficient and more than 40% of children age 0-4 in developing countries suffers from anemia[15] (ACC/SCN 2000a). In the case of iodine deficiency, about 285 million (36.5%) children aged 6 to 12 years globally are affected by it (SCN 2004).
Regarding Vitamin "A" deficiency, around 127 million (25%) preschool aged children are Vitamin "A" deficient[16] with almost half of these children living in South and Southeast Asia and 10% in the eastern Mediterranean region. Blindness from severe vitamin "A" deficiency (Xerophthalmia) afflicts 4.4 million (0.9%) preschool aged children of whom 40% are living in India (SCN 2004).

2.3 Effects and Consequences of Malnutrition

Malnutrition is an impediment to survival, health and development for present and future generations and causes a great deal of human suffering-both physical and emotional and is a violation of a child's human rights (Oshaug, W. Eide, and A. Eide 1994) . Prolonged or severe protein and energy depletion (PEM) will eventually reduce the linear growth and will lead to loss of or failure to acquire muscle mass and fat in both children and adults (Behrman JR et al 2004).
Stunted children have an increased risk of morbidity, mortality, delays in motor and mental development and decreased work capacity leading to reduced economic productivity during adulthood (SCN 1997, Waterlow and Schurch 1994, Pelletier et al 1993, Schroeder et al 1994) . Due to the reduced cognitive capacity of malnourished children, learning in school becomes more difficult, they are more absent from school due to infections, and they score more poorly on tests of cognitive function. They also have poorer psychomotor development and fine motor skills, lower activity levels, interact less frequently in their environments and fail to acquire skills at normal rates (Grantham-McGregor, et al. 1999 as cited by Behrmen JR 2004). If the situation leading to malnutrition does not change before the age of 2 years, the resulting stunting and impaired cognition may become largely irreversible (Mendez MA et al., 1999).
The effects on growth impairment are mostly seen in the first 2-3 years of life (WHO 1995) . This may be explained by the following:

- This is the age of the most rapid growth rate.
- Nutritional requirements per kilogram of body weight are highest in infancy.
- Young infants are more susceptible to infection.
- They are unable to make their needs known and thus are highly dependent on the caregivers good care practices.

Malnourished children are more susceptible to infections and to developing more severe forms of infectious diseases as malaria and meningitis (Man WDC et al.1998). They have about two to three time's higher risk of dying from a simple infection as acute respiratory infection than a well nourished child and for diarrhea, a malnourished child is more likely to suffer longer and more severe attacks leading to increased chance of death (Rice A et al.,

[15] Anemia in children is blood hemoglobin of < 110g/l in children less than 6 years of age, < 115g/l in children 6-11 years, < 120 in those 12-14 years (Ross J and Horton S 1998) . Anemia is used as a proxy for iron deficiency anemia.
[16] Defined by serum retinol <0.70mcmol/L or, occasionally, abnormal conjunctival impression cytology (West K 2002).

2000). Although severely malnourished children have a much higher risk of dying than mildly or moderately malnourished ones, the majority of deaths (76-89%) are linked to those children who are only mildly or moderately malnourished. This is explained by the fact that many more children are mildly to moderately malnourished than severely malnourished and thus their total impact is larger (Pelletier D et al., 1994). It is estimated that persistent malnutrition is contributing to at least 5.6 million deaths, and about 60% of under five child deaths are associated with malnutrition (UNICEF 2006, WHO, 2000)(See **figure 2**). The significantly increased risk of illness and death among stunted and underweight children has been shown to persist even after controlling for their poorer physical and socio-economic environment (Pelletier 1994, Vella et al. 1994).

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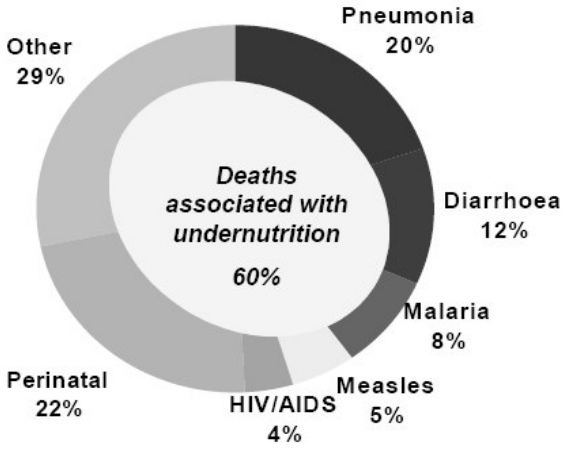
Figure 1: Major causes of death among children under five, Worldwide, 2000



Sources: WHO/EIP, 2000

Another important consequence of malnutrition is described in the so called "Barker hypothesis" which states that in response to fetal malnutrition there are adaptive redistributions of fetal resources leading to an increased risk of developing chronic diseases in adulthood such as heart disease, stroke, and diabetes (Barker 1998). Future high health costs from these diseases will be difficult to meet in the poor countries.

Micronutrient deficiency can be detrimental to children, the extent of which depends on the type and severity of the deficiency. For anemia, consequences in childhood include diminished cognitive capacity affecting schooling, delayed motor development and decreased linear growth rate (Lozoff et al. 1991, Lawless et al. 1994).

Iodine deficiency causes cognitive impairment and has been shown in a meta-analysis to reduce I.Q by about 13.5 points in children (Grantham-McGregor, Fernald and Sethuraman 1999b).

The consequence of Vitamin "A" deficiency includes both impaired immunity with its consequent increased risk of infection and night blindness which may progress to development of damage to the cornea with complete blindness.

Therefore, if malnourished children survive childhood, they will suffer from more chronic illness and disability as adults and their ability to assure good nutrition for their children could be compromised, perpetuating a vicious cycle with an intergenerational effect (UNICEF 1998, Anderson P 2000).

Eliminating malnutrition would cut mortality under fives by more than 50% and reduce the burden of disease in the developing countries by about 20% (Tomkins and Watson 1989, FAO/WHO 1992, Pelletier et al. 1993, Murray and Lopez 1997).

2.4 Causes of Childhood Malnutrition

In view of the extent and consequences of malnutrition as well as its importance in realizing the Millennium Development Goals, it is important to reduce childhood malnutrition, but in order to do this the determinants of malnutrition must be understood. The main causes of malnutrition will be analyzed using the UNICEF conceptual framework which divides the causes into immediate, underlying and basic determinants (See Annex 7).

Immediate causes include inadequate food intake or disease or a combination of both. Infection may reduce the appetite and food absorption and increase the energy demands, while inadequate nutrition will reduce the immunity and therefore the child will become more susceptible to further infection causing a vicious cycle which may end in malnutrition and death (Tomkins and Watson, 1989).

The underlying causes which determine the immediate causes include household food insecurity[17], inadequate maternal and child care and an unhealthy environment and insufficient services. Household food insecurity may result from a number of interrelated causes as for example poor crop yields, low incomes, high food prices, lack of access to assets as land or water. With household food insecurity, infants and other vulnerable groups will most likely suffer the brunt and receive an inadequate diet. Maternal and child care refers to the activities and services to provide adequate nutrition and proper health care to women and children. Insufficient and poor health services and unhealthy environment with unclean drinking water and, poor hygiene disposal system will increase the risk of infections as diarrhea. Although household food security is important, it is not a sufficient determinant of malnutrition. The presence of resources and control over them, determines whether there is enough food, care and health. Whether these resources are used to fulfill the requirements of food security, health and care is determined by education (Haddad 2005). According to Smith LC and Haddad L, 2000, education of women is a powerful weapon against malnutrition as increased knowledge and skills enable women to earn higher incomes, and thus enhance household food security as well as it improving the quality of day-to-day care women give to their children. The importance of mothers schooling relative to the fathers was shown by Schultz, (2001), who found that increasing mothers schooling will have a larger beneficial effect on child's health, schooling and adult productivity compared to increasing fathers schooling by the same amount.

The basic causes of malnutrition are related to human, economic and organizational resources and the control over them. These are further determined by the potential resources available to a country. However, the utilization of these potential resources and how they are translated into resources for food security, care, and health environments and services is affected by the political and economic structure together with the socio-cultural environment (Smith LC and Haddad L 2000).

[17] Food security as defined by FAO (1996) means the access by all people at all times to the food needed for an active healthy life while at the household level it refers to the ability of the household to secure either from its own production or through purchase of adequate food for meeting the dietary needs for its members.

CHAPTER 3: Problem statement, objectives and Methodology

This chapter will first discuss the problem of child malnutrition and female education in Yemen, then the general and specific objectives of this thesis and finally the methodology used to analyze the association of child malnutrition to female education in Yemen and globally.

3.1 Childhood malnutrition and female education in Yemen

According to a recent report by the UNICEF 2006, Yemen still suffers from one of the highest rates of under five malnutrition in the world. In addition malnutrition trends in the MENA region reveal that Yemen is still among the few countries that are not decreasing in underweight prevalence (See Annex 8). Nutritional indicators among children below five

years of age show that the rate of underweight is about 46% and that for stunting is 53% while for wasting it is about 13 %(DMCHS 1997). Levels of stunting indicate that more than half of children are chronically malnourished.
According to the WHO classification for the assessment of malnutrition severity (See Annex 9), the anthropometric figures for malnutrition put Yemen among the countries of very high severity for stunting and underweight and at high severity for wasting. This WHO assessment indicates that in Yemen malnutrition is a severe public health problem.
When looking at the nutritional indicators in relation to age (see Table 3), it is found that the prevalence of stunting increases at the age of 12 to 23 months, from 33% in children 6 to 11 months to 61% and reachs a peak of 65% at 48 to 59 months. While for wasting, the prevalence is 19% between ages 6-23 months after which it falls to 10% at 24-35 months to reach a level of 8% at 48 to 59 months. In the case of wasting, the peak coincides with the age of the weaning period and therefore indicates that supplementary foods may not be sufficient at that time. As for underweight, prevalence is seen to increase very rapidly after the first 5 months of life from 13% to 42% at 6 to 11 months and reaches a peak of 55% at 12 to 23 months. Thereafter it decreases slightly to reach 51% in the fifth year of life (Demographic and Maternal and Child Health Survey DHS, 1997). Therefore, we can see that after the first 6 months of life, levels of malnutrition start to increase rapidly indicating that children are having deficiencies in nutrients even before that time.

Table 2: Nutritional status of children under five years by age in months, in Yemen.*

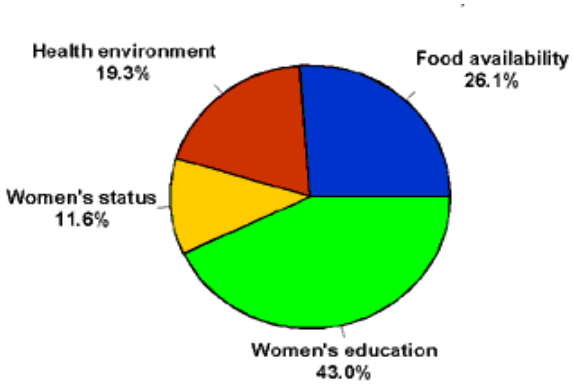
	0-5 months	**6-11 months**	**12-23 months**	**24-35 months**	**36-47 months**	**48-59 months**
Height for age (% below -2 SD)	16.4	33.0	60.8	57.9	62.2	64.6
Weight for height (% below-2SD)	10.9	18.9	19.2	10.4	9.0	8.3
Weight for age (%below -2SD)	12.9	41.8	54.8	53.3	51.0	50.8

Source: DMCHS 1997
*Note: Figures are for children born in the period 0-59 month's preceding the survey of 1997. Figures here include children who are both -2 and -3 SD below the median for age.

LBW is high in Yemen at a prevalence of 32%. The danger of LBW females maybe seen in adulthood where they may be malnourished and have a greater risk of delivering LBW infants resulting in the intergenerational cycle of malnutrition. In addition, stunted women may develop complications during delivery. In Yemen this is especially important as about 84% of women deliver at home and therefore these women may suffer from increased morbidity and mortality with home deliveries(DMCHS 1997).
The major causes of malnutrition in Yemen include infectious diseases (the commonest being diarrhea and respiratory tract infection), lack of knowledge about nutrients, improper feeding practices, lack of micronutrients, and in some instances lack of food (UNICEF State of the World's Children 1998). In Yemen only 23.3% of children less than 3 months are exclusively breastfed and about 49% of children less than 12 months are bottle fed (DMCHS 1997). The low rate of exclusive breast feeding together with the high rate of children who are bottle fed may be contributing to the diarrhea among the children.
As stated previously, the consequences of early child hood malnutrition may lead to both physical and cognitive problems. Although the physical consequences have been shown in Yemen with the high prevalence of stunting, the cognitive problems have not been properly

studied. Stunting may lead to adults who are less economically productive with the possibility of an increased risk of developing chronic diseases such as heart disease, stroke, and diabetes. These will lead to high future public health costs which will be difficult to meet in Yemen.
Yemen has also committed itself to the Millennium Development Goals and has ratified the convention to the rights of the child but with the level of underweight documented now, it seems that it is unlikely that the MDG target of halving underweight in under fives by 2015 will be met (Yemen Millennium Development Goal report 2003).
As improvements in women's education have contributed by far the most to reductions in child malnutrition, accounting for 43% of the reduction in the years between 1970-1995, while improvements in per capita food availability contributed about 26% (Smith LC and Haddad L, 2000) , this paper will look into the role of female education in the high rate of childhood malnutrition in Yemen (see Figure 2).

Figure 2: Estimated contribution of major determinants to reductions in child malnutrition*, 1970-95



Source: L.Smith and L.Haddad, Overcoming Child Malnutrition in Developing Countries: Past Achievements and Future Choices (Washington, D.C: IFPRI, 2000).
***Note**: Malnourished children refer to underweight children.

Many agencies such as the World Bank and United Nations have realized that female education is one of the main factors in the development of a country both economically and socially. According to UNESCO (2005) primary school age children of uneducated mothers are more than two times as likely to be out of school as children of mothers with some education (UNESCO 2005).
In Yemen, education level lags behind other countries in the region. This is especially true for the females. The overall literacy rate in Yemen is about 49% (UNDP 2003) indicating that about half of the population is illiterate, which is one of the highest rates in the world. The female literacy rate is only about 30% while for males it is around 70% which means that two out of three women are illiterate in Yemen. The school enrolment of females is only 41% (UNDP, 2005).
The importance of female education lies in the fact that females (mothers and older siblings) are the main caregivers of children in Yemen, they form the human resource for care of children. Enhanced care giving can improve the use of limited resources and promote good health and nutrition in the presence of food insecurity (Engle P 1999). Therefore, if females are educated it is assumed that their caring practices will improve, resulting in improvement of their children's nutrition.

3.2 General and Specific Objective's

The general objective of this thesis is to analyze the role of female education in the development of malnutrition in young children and to further analyze available intervention programs related to education in order to advice the policy makers on the most appropriate ways of increasing female education as step to improving the under five malnutrition problem in Yemen.

In order to achieve the general objectives the following specific objectives were formulated:

1 To describe the nutritional profile of Yemen in order to identify the major nutritional problems and their causes.
2 To identify possible causes of low female education in Yemen.
3 To analyze the available evidence in literature of the role of female education in childhood malnutrition.
4 To analyze the association between female education with nutrition and various care practices in Yemen.
5 To identify the possible approaches to improve female education and determine how it affects their child's nutrition.
6 To provide recommendations to policy makers as well as senior program managers (whether in government, donor agencies or NGO's) on ways to improve female education as means of improving childhood malnutrition.

3.3 Methodology:

3.3.1 Literature Search:

The thesis was conducted through a literature search of available published and unpublished studies on female education and under-five malnutrition. The search strategy was aimed to find documents on the role of female education to child malnutrition and on the available interventions aimed at correcting low female education in developing countries. The search was restricted to those studies published from January 1990 to 2006 in developing countries except for a few relevant articles which were published before that time.
Internet search was done using Pub Meds mesh data base, Science direct, Google scholar as well as search in sites of organizations like WHO, UNDP, UNICEF, UNESCO, FOA. Library search was done using books from KIT and Vrije University Library, as well as the use of other printed documents and books.
The **key words** used were*: malnutrition, stunting, underweight, wasting, children, female education, Yemen, developing countries, nutrition programmes, school feeding.*
The 1997 Demographic and Maternal and Child Health Survey was used (the latest edition) to determine the association between the level of the female education to certain care practices as well as to fertility and contraceptive use in Yemen.

3.3.2 Framework of Analysis:

The extended model of care adapted from the UNICEF conceptual framework (See Annex 10) has been used for this thesis to analyze the role of female education in certain care practices (globally and in Yemen) and childhood malnutrition
In this UNICEF extended model, the care giving behaviors such as feeding/breastfeeding, psychosocial and cognitive stimulation, hygiene practices and food preparation and storage are shown to be dependent on adequate caregiver resources as education, time and support.

The provision of these resources can be considered as care for the caregiver (Engle P et al., 1999).
In the framework there are six major categories of care giver resources needed for adequate child care which include education, knowledge and beliefs as on of them. The thesis uses this framework to analyze the role of mother's education as a caregiver resource to improved care giving behaviors in developing countries and in Yemen for the purpose of improving the nutrition of children. The care giving behaviors analyzed will be infant feeding/breast feeding behaviors, hygiene behaviors and health seeking behaviors. In Yemen, due to lack of adequate research on child care, various proxies have been used to analyze the role of mother's education to care practices in Yemen using the 1997 Demographic and Maternal and Child Health Survey. Exclusive breast feeding and age of introduction of complimentary foods is used as a proxy for infant feeding care practices, the number of children with diarrhea is used as a proxy for better hygiene behaviors, the number of children immunized, and the number of women receiving ante-natal care and 2 doses of tetanus toxoid and consulting a health facility will act as a proxy for health seeking behavior. Although the role of education to fertility rate is not included in the framework, in this thesis fertility rate with modern contraceptive use will be analyzed in relation to female education as a proxy for mother's autonomy[18] and her ability to provide food and care for her children.
As this study is based on literature review it has its limitations. There was a lack of published literature on child care practices in Yemen. Recent information was lacking for infant feeding practices and food consumption, mothers health seeking behavior and family planning in relation to mothers education. As for mothers hygiene behaviors there was a complete lack of published information. In addition although different intervention programmes exist in Yemen related to nutrition and education, there was a lack of accessible published evaluation reports on these programmes highlighting the deficiency of evaluation in Yemen.

In the following chapter 4, the literature analysis was used to describe nutrition and food profile in Yemen, female education in Yemen and its underlying causes, how female education is influencing childhood malnutrition world wide and in Yemen. Chapter 5 will analyze the available intervention programs for childhood malnutrition. Finally, chapter 6 will include the recommendations and conclusions for improvement of childhood malnutrition in Yemen.

[18] Maternal autonomy refers to the caregiver's ability to play a role in decisions made within the household and the community (Engle P and Menon P 1999).

CHAPTER 4: MALNUTRITION AND FEMALE EDUCATION GLOBALLY AND IN YEMEN.

In this chapter an attempt has been made to analyze and asses the food and nutritional profile of Yemen, the educational disparities in Yemen, female education and its role in childhood malnutrition and finally to analyze the role of female education for certain care practices in Yemen.

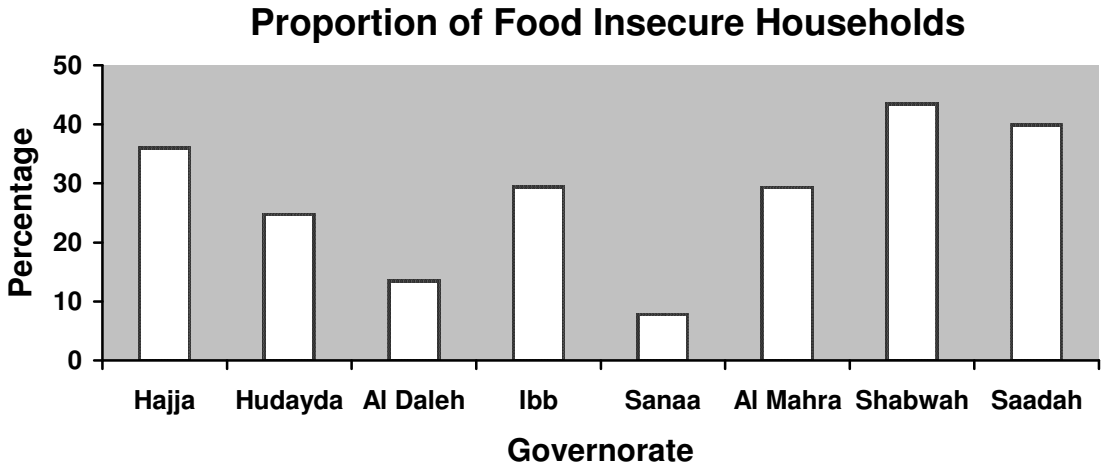
4.1 FOOD AND NUTRITION PROFILE OF YEMEN:

This section will describe the food security with its disparities in Yemen, the nutritional deficiencies and the food habits.

4.1.1 Food Security

Yemen is classified as a Low-Income and Food Deficit Country (LIFDC) and imports over 85% of its food (Al-Makhlafi H 1999). About 17.6% (2.9 million) of the Yemenis are below the food poverty line[19], consuming less than 2,200 Kcal per capita per day with most of theses calories (65-70%) coming from grains. Of people below the food poverty line, 87% live in rural areas (Household Budget Survey (HBS), 1998). There are great disparities in food insecurity amongst governorates, with the proportion of food insecure households ranging from as low as 7.8% in Sana'a City to as high as 43.5% in Shabwah (Figure 3).

Figure 3: Proportion of Food Insecure Households in 8 Governorates of Yemen. 2003



Source: FAO Food Insecurity in Yemen report based on results of the 2003 FIVIMS[20] Survey.

Poor households may have the disadvantage of not having the means to produce or the purchasing power to obtain the food they need. Although, previously, acute food crises were rare due to good social safety net, it is worsening due to reduction in solidarity and changing social values. The United Nations World Food Programme claims that 7.9% of the population regularly experiences severe food insecurity (IRIN 2006). Food security in Yemen is endangered by the water scarcity, high population growth rate and poverty.
Rapid depletion of ground water resources in Yemen poses a threat to food security. According to Dr. Walid Saleh, a Middle East water expert, groundwater will become too expensive for use in agriculture and regional agricultural economies based on groundwater irrigation will become destined to collapse if the water resources are not adequately

[19] Food Poverty is insufficient income to meet the basic essential food requirements. According to the 1998 Household Budget Survey (HBS), the food poverty line is Yemen Riyal (YR) 2,101 per month per individual at the national level to meet the needs represented by 2,200 calories, compared to YR 3,200 for the upper poverty line. Both poverty lines differ among governorates and between rural and urban areas (Yemen Poverty Reduction Strategy paper 2002)
[20]FIVIMS: Food Insecurity and Vulnerability Information and Mapping Systems

controlled (IRIN 2006). This is catastrophic as 75% of the population depends on agriculture as a main source of livelihood.
High population growth rate poses another threat to food security. The high growth rate (3.02%) in Yemen is already resulting in insufficiency of food leading to increasing reliance on imports to meet the needs of the people.
Poverty will limit the ability of the country to import food for its growing population. Household food security[21] especially in low income households can be affected by the threat of drought, diseases outbreak, and floods; falling per capita incomes; inefficient and poorly integrated food markets; and geographical isolation.

Due to the unfortunate neglect of the traditional rain fed cereal production, local production, which had previously covered almost all cereal requirements in 1970, was reduced to only 26% of an estimated cereal availability of 3.2 million tons by 1998 requiring governments to import (FAO). Grain production is the lowest in the Arab countries with over 75% of wheat, the main staple food, being imported.
In the 1980's the agricultural sector became dependent on market oriented and irrigation-dependent cash crops as fruits, vegetables and Qat[22]. The total amount of vegetables and fruits available for the Yemeni individual per year is lower than that available for other people in different countries (HBS 1992).[23]

The chewing of qat requires special mentioning as it consumes a relatively large portion of the family expenditure reaching a level of 11.2% and competing with food expenditure which consumes 53% of family expenditure. Qat also has an adverse effect on the ability of the body to absorb nutrients as well as reducing appetite. About 42% of the Yemenis chew qat and 25% chew daily (FHS 2003). Qat cultivation also consumes large amounts of water and land (70% of the area used for sustainable agriculture). With the problem of low availability of water resources, cultivation of qat has become an important and critical albeit difficult issue that the government has to address (HBS 1998).
In regards to meats and meat products, milk, poultry meat, eggs and honey that were produced during the period 1991 to 1997, quantities available are not enough to feed the population. In general, the contribution of the animal and sea wealth, as an important agricultural sector, is small as compared to the overall demand. This could be related to the weakness of the required services for the production of these types of food resources (Central Statistical Organization, 1998).

4.1.2 Nutritional Status

It is estimated that about 1.7 million Yemeni women and children are affected by chronic malnutrition (UNICEF 1998). As discussed previously the prevalence of stunting, wasting and underweight is high among the under fives at 53%, 13% and 46% respectively (DMCHS 1997). Childhood malnutrition in Yemen shows both residential and regional disparities in prevalence. Residential disparities in malnutrition show that the prevalence is higher for rural residents than for urban residents as 56% of rural residents versus 40% of urban residents are

[21] The ability of the household to secure, either from its own production or through purchases, adequate food for meeting the dietary needs for its members.

[22] Qat is a green leaf that contains an amphetamine like substance and is chewed for its stimulant effect, mostly by adults and sometimes by children.

[23] In Yemen the vegetables and fruits available for each individual per year is 76.8kg and 22.3kg respectively where as for Lebanon it is 314kg for vegetables and 459kg for fruits (Al-Sayed M 1998.Arab food Security. World Information Series 230).

stunted, 14% of rural residents versus 10% of urban residents are wasted and 50% of rural residents versus 36% of urban residents are underweight (see Table 3).
Regional disparities, among children under five show that for stunting the prevalence is lower in the coastal region (42%) than in the mountainous regions (59%), for wasting, the prevalence is lower in the plateau and desert region (9.4%) than in the coastal region (20%) while for underweight prevalence is lower in the plateau and desert region (43%) than in the mountainous region (52.1%). In general it can be said that the Mountainous region has the highest prevalence for both stunting and underweight whereas for wasting, the coastal region has the highest prevalence.
Trends in underweight show a worsening situation which can be explained by a combination of inadequate calorie intake and LBW; lack of breastfeeding and diarrheal diseases, malaria and other endemic diseases (Khan Q and Chase S 2003).
In general, gender disparities in malnutrition are not significant with only a slight increase in the prevalence for males (see Table 3). According to observation, the reason for lack of gender disparities could be explained by the fact that young children eat separately with their mothers and receive the same type of food as their mothers irrespective of their gender but this observation requires caution when generalizing due to lack of research.

Table 3 Nutritional status of children under five years according to residence and region

	Residence		**Region**			**Gender**	
	Urban	**Rural**	**Coastal**	**Mountains**	**Plateau and Desert**	**Male**	**Female**
stunting (%)	40.3	55.7	42.0	58.8	52.9	52.3	51.0
wasting (%)	10.4	13.7	20.0	12.8	9.4	13.7	12.0
Underweight (%)	35.5	49.9	46.0	52.1	43.2	47	45.1

Source: Demographic and Maternal and Child Health Survey 1997

Protein energy malnutrition in the mother is the prime cause of low birth weight in developing countries. Often these same mothers themselves suffered from low birth weight, stunting and anemia (FAO 1996, Al-Makhlafi 1998). Therefore improving the mother's nutritional state may reduce the level of LBW in Yemen.
According to the UNICEF, an alarming 80% of the Yemeni population suffers from anemia and an estimated 59% of under-five children have iron deficiency anemia (UNICEF 2004). It is estimated that about a fifth of maternal deaths during pregnancy and delivery are a result of severe anemia and children born to anemic mothers have increased risk of low birth weight and death in the perinatal period. The main contributing factors include low iron intake in the diet, intestinal parasites and malaria.

Regarding Iodine Deficiency Disorders (IDD) in Yemen, the National Survey of 1998 shows the proportion of school age children (6-12 years) with urinary iodine (UI) of less than 100 mcg/dl is about 30%,[24] while the total goiter prevalence (TGP) in school age children is about 17% showing a marked improvement to the 1991 WHO rapid survey on TGP which showed a prevalence of 32% (although it was conducted on only four governorates). [25]

[24] Recommended goal is less than 50% of population with less than 100mcg/l of UI excreation, in order to achieve sustainable IDD elimination.
[25] WHO Global Data base for Iodine deficiency.

Anecdotal evidence suggests possible causes of IDD to be lack of fish in the Yemeni diet, poor iodine content of the soil and failure to use iodized salts. The prevalence of IDD decreased due to the introduction of salt iodization in Yemen in 1996. Although the percentage of households who consumed iodized salt increased to 60%[26] in 2001 showing a nearly three-fold increase of the rate of 22% reported in 1995, it is not sufficient to realize the goal of IDD elimination. However, Yemen is now classified as a country with mild IDD (Azizi F and Mehran L 2004).

The estimated number of children under 6 with sub-clinical vitamin A deficiency is 40% and the estimated annual number of child deaths precipitated by vitamin A deficiency is 10,000 (MI and UNICEF 2003).[27] Fortunately Vitamin A supplementation is now delivered with Polio vaccination campaigns to all children from 6 months to five years, and its coverage rate reached to 95% in 2000 (UNICEF, 2003). This will reduce the Vitamin A related mortality rate in children.

4.1.3 Food Consumption Patterns

Food consumption patterns in Yemen have not been thoroughly studied yet and only information obtained from a rapid assessment survey among women at mother and child centers in Sana'a is available. However, anecdotal evidence shows that food consumption patterns for the children (after the first year of age) are similar to that of their mothers irrespective of their gender, as children eat with their mothers while men eat separately with older sons and male relatives. The survey shows that 3 meals are consumed daily with lunch being the main meal. The types of food consumed depend on geographical distribution and socio-economic status of the families. In general the people of low socio-economic status mainly consume bread with tea for breakfast and dinner, while for lunch they mostly eat rice and *Helbah*[28] with bread. Among higher socio-economic families, breakfast and dinner may consist of beans, eggs, bread with tea, while lunch will include rice with vegetables, *Helbah*, bread and meat.

It could be said that the main consumed types of foods in Yemen are cereals, sugar, honey and vegetables' oils. These types of foods provide about 77-85% of the daily calorie supply (FAO 1995) ; however, grains alone cover more than half of the available calories while energy from protective foods such as meats, fish and milk cover only 4.2 to 7.4% of total calories indicating that the quality of the diet in terms of protein and micronutrients is compromised. The high socio-economic families may be able to consume an adequate amount of proteins. Female education, income, social and personal traditions as well as other factors may have played a role in the level of nutrients deficiencies in the diets of pregnant and lactating women (Al-Makhlafi H, 2001). In general, consumption patterns of pregnant mothers do not differ from other household members but for post delivery mothers, extra food is allocated to them for about one month including meats and high energy foods as *fatoot*.[29]

Although the food habits for young infants have not been studied, anecdotal evidence shows that young children consume mostly carbohydrate based foods as cereal and rice and do not consume much protein rich foods as meat and eggs. Commercial biscuits and commercial baby cereals are replacing the traditional complementary foods as *Shabeesah*.[30]

[26] Recommended coverage is 90% to achieve sustainable IDD elimination.
[27] The Micronutrient Initiative and UNICEF 2003)
[28] Helbah is made mainly of chicken or meat broth and fenugreek
[29] Fatoot is made of bread, honey, ghee and sugar.
[30] Shabeeshah is a cereal porridge made from different grains and cooked with water or milk.

According to UNICEF (2006), studies done during the years 1996 to 2004 showed that in children less than 6 months, only 12% are exclusively breast fed and 76% of children will continue to breast feed in addition to receiving complementary feeds at 6 to 9 months of age Anecdotal evidence shows that families believe that colostrum is not sufficient for the baby; therefore pre-lacteal feeds of water and sugar or artificial milk are given until the breast milk is produced. In addition to breast milk, supplementary feeds with ghee or butter, or biscuit and milk are also given to babies (before 6 months of age) based on the misconception that they will be healthier and sleep better. In case of lack of breast feeding commercial milk formulas or fresh milk from goats or cows is given through a bottle. Unfortunately, artificial feeding is getting more common in Yemen. General observation shows that there is excessive dilution of milk to conserve the milk powder and improper sterilizing of bottles among the poor which may lead to worsening of malnutrition among under fives.

4.2 Female education in Yemen:

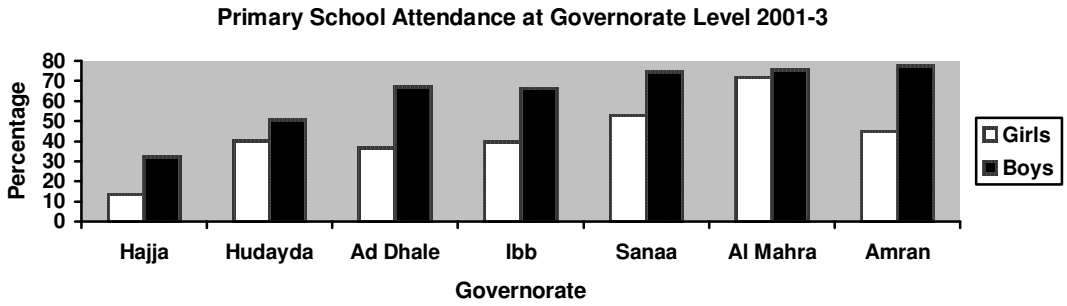
This section will analyze the disparities between males and females in education, and the possible reasons behind this high gender disparity in Yemen.

4.2.1 Disparities in Education

Although Yemen has realized the importance of education, it has still one of the highest illiteracy rates and lowest school enrolment in the region and in the world. There are great disparities between boys and girls enrollment and between different governate and regions of Yemen. Gross school enrolment rates rose from 58 per cent in 1997-1998 to 67 per cent in 2003-2004, but the rate for girls was only 52 per cent in 2003 (United Nations 2005). Low female education is more severe in rural areas where only 2.5% complete primary education and only 0.4% complete secondary education in comparison to urban areas were 6.9% and 3.8% complete primary and secondary education respectively (DMCHS 1997).
Among the governorates, Hajja governorate has the lowest primary school attendance for both boys (32.2%) and girls (13.4%) while the highest attendance for boys is in Amran governorate (78%) and for girls it is in Al Mahra governorate (72%). Regarding gender disparity[31], Hajja governorate shows the largest disparity (42 girls for every 100 boys) while the lowest is seen in Al Mahra governate (95 girls for every 100 boys) (see Figure 4). The high gender disparity in Hajja may be explained by the presence of mountainous regions with scattered communities mostly in the rural areas (only 9% of Hajja population live in the urban areas) making it more difficult for girls to travel to school. On the other hand, around 42% of the population in Al-Mahra governorate lives in the urban region which may explain the lower gender disparity in education as girls may have a higher chance of going to a nearby school. Further research will be needed to explain other causes for these disparities.

Figure 4: **Primary School Attendance at Governorate Level 2001-3**

[31] Measured by the ratio of girls to boys.



Source: Child Development Project, baseline survey, 2001-2003, UNICEF and GOY

T**able 4** shows the percent distribution of the population (10 years and older) according to educational level, sex and area of residence. Regarding illiteracy, 36.2% of all children 10 years and older in Yemen are illiterate. A higher percentage in illiteracy is seen for females (69.1%) as well as children in rural areas (44.4%). Regarding children who can read and write the total percentage is 24.3% with not much difference between rural and urban areas. Apparently fewer females can read and write compared to males in rural areas whereas the general difference between males and females in the ability to read and write is less pronounced in urban areas.
The proportion of children with formal education is very low, being 9.5% with primary education and reducing to 1.9% with university education. At all levels, percentage of persons with education is larger in urban areas compared to rural areas, and in both urban and rural areas, less females are educated compared to males at all levels of education.

Table 4: Percent distribution of the population (10 years and older) by educational level, sex & area of residence

~~Not stated~~	~~0.4~~	~~0.5~~	~~0.5~~	~~0.6~~	~~0.6~~	~~0.6~~	~~0.6~~	~~0.5~~	~~0.6~~
Educational level	Urban			Rural			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Illiterate	15.2	40.5	27.9	31.1	57.7	44.4	27.3	69.1	36.2
Read & write	29.1	24.5	26.8	31.8	15.0	23.4	31.1	17.3	24.3
Primary	13.2	9.9	11.6	12.8	4.7	8.8	12.9	6.0	9.5
Preparatory	17.2	11.4	14.3	12.1	2.8	7.5	13.4	4.9	9.2
Secondary*	18.2	10.6	14.4	9.7	1.2	5.5	11.8	3.5	7.7
University	6.6	2.6	4.6	1.9	1.0	1.5	3.0	0.7	1.9

Source: Family health Survey (FHS) 2003.
*For all tables and figures, Secondary refers to secondary school complete.

Even if girls enroll in schools they have a high drop out rate. According to the National strategy for girls' education (1998), from 100 girls enrolling in the first class of basic education only 23% reach the 9th class of primary education with drop out starting in the 5th grade and reaching a peak in the 7th to 8th grade (Ministry of Education 2006).

4.2.2 Reasons for Low Female Education in Yemen

According to field studies conducted by the Ministry of Education (MOE 2004), several reasons for the low enrolment and high drop out of females have been identified which include the following:

Financial constraints and opportunity costs: Almost half of the Yemenis are living below $2 per day (PPP) and therefore schooling of children may be relatively expensive. Direct costs (yearly school fee, school uniform, transportation and other school supplies) may be too much for poor families especially those with a large family size which is often the case in rural areas. Families believe that investment in girl's education will have no return for the family's future while their marriage will benefit the family financially as they receive a *"mahr"*.[32] As women provide an estimated 60% of agricultural labour, they need their daughters to stay at home and take care of their young siblings, do household chores or work in the farm (Al-Makhlafi H, 1998). Therefore, the opportunity costs of girls schooling is higher than for boys and in case of financial constraints, families prefer to keep girls rather than boys at home.

Conservative attitudes of the family: This plays an important role in low female education in Yemen. The family may be opposed to the girl leaving the home or attending a coed school or being taught by a male teacher for reasons that may vary from traditional to religious. A low number of female teachers in the rural areas compared to the urban ones (only 8% of teachers are female in rural areas in contrast to 46% in urban areas), may partly explain the disparity between rural and urban areas for female education (Khan Q and Chase S 2003).This conservative attitude becomes even stronger once a girl reaches puberty partly explaining the increasing dropout and low enrollment of girls with each year of school (MOE 2004). These attitudes are especially widespread in the rural areas and are difficult to tackle due to the lack of sufficient female educators in schools and limited number of segregated schools for girls.

Perceptions of roles and responsibilities: The perceptions dictate to families that girl's education is irrelevant. Their perceived job is to work in the house or farm and then get married and have children. This perception of girl's roles may also contribute to the increase in dropout of girls at puberty to get married. According to the DMCHS 1997, 29% of women, 15-24 years of age, who were not in school stated that they left school because they got married (DMCHS 1997).

[32] *Mahr* or dowary, refers to a sum of money given to the father by the groom's family for the marriage of his daughter.

Lack of proper school facilities and irrelevant educational content: Due to limited number of schools which may be situated remotely from a girl's home, as may be seen in rural areas, security issues arise for the safety of the girls traveling alone to school. This may discourage parents from allowing their daughters to travel to these remote schools with out an appropriate chaperone. Lack of latrines for girls has also been cited as a factor contributing to girls' not attending school. The irrelevance of curriculum content to the future needs of rural girls in agriculture has also been cited as a reason for not enrolling or dropping out of school (MOE 2004).

Parents Lack of awareness: Some families are just unaware of when to send their daughters to school, resulting in a missed opportunity for these girls (MOE 2004). This lack of awareness may stem from the parents themselves being illiterate, living in remote areas and also being unaware of the importance of female education.

4.3 Evidence in literature of the role of female education[33] in childhood malnutrition:

This section will look at evidence from available literature showing the association between mother's education and child malnutrition followed by the analysis of the role of female education to certain care practices. Finally the pathways that describe how educated mothers benefit from schooling to improve care practices will also be analyzed.

4.3.1 Evidence from literature on the association of mothers education to child malnutrition

Several studies in various developing countries have shown an association between mothers' education and child malnutrition. In a rural area of Karachi, Mothers' literacy status was shown to strongly affect the nutritional status of their children with maternal illiteracy posing a threat for the development of malnutrition especially for underweight among children under 3 years of age (Ali S et al. 2005). In a study in the Philippines, Barrera showed that children of better educated mothers have higher height-for-age scores especially significant for children in the weaning period (less than 2 years of age). Family income as a confounding factor was shown to not be statistically significant in this study (Barrera, 1990).

[33] Mothers education includes both formal schooling as well as education provided in adult life as literacy programmes.

In another study in a rural district of Uganda, the chance of being stunted among children under 2 years of age doubled when the mother was not educated or stopped education in primary (Odds ratio 2.1) compared to mothers completing primary school whereas only feeding and morbidity were significantly associated with wasting and underweight (Wamani H. 2006).
In Peru, it was shown that over half of children whose mothers have no education (51.6%) are stunted, compared to 15% of those with secondary, and 7% of those with higher level of education (ENDES, 2000 as cited by Rogers BL et al 2002).[34] No education among these mothers was associated with early child bearing and having more children who are more closely spaced with the danger of leading to low birth weight and subsequent stunting (i.b.i.d).
In a paper by Goodburn et al.1990 , conducted in the rural parts of West Bengal, mothers attending the Child in Need Institute (CINI) were studied. It was shown that the nutritional status of both the mother and child were better in the educated than the not educated group in spite of equal utilization of CINI. The difference was significant for height for age and persisted after controlling for socio-economic status. Also, the educated mothers had a smaller family size which impacts positively on child's nutrition and health. In addition, they responded more positively to the health message of the programme even though the health messages were directed to the non educated mothers.
In a study in Ghana, Appoh et al show that the maternal schooling improves the child's nutrition if accompanied by nutritional education. This study also showed that although family economic status was related to child nutrition its impact was less than that of nutrition education (Appoh L & Krekling S 2005).

Mother's literacy provided in adult life has also been shown to promote better nourished children. This was shown in a cohort study in Nicaragua (Sandiford P et al., 1995) were a mass campaign called Cruzada Nacional de Alfabetizacion (CNA) or National literacy Crusade taught 406,056 illiterate adult men and women how to read and write. This gave a good opportunity to study the effect of literacy in a group of women and compare the child's health to illiterate women who have the same socio-economic background. The results showed that the prevalence of low Mid Upper Arm Circumference (MUAC)[35] for age was 60% higher in children of the illiterate than in children of women in the adult education group ($p < 0.001$), prevalence of childhood underweight ($p=0.01$) was about three times that of children of mothers who had received adult education. For mothers who had received formal schooling it was about the same as adult educated mothers. The same was seen for stunting of children were those with adult educated mothers had 34% lower risk of severe stunting than those of illiterate mothers ($P<0.05$) but the rate for children whose mothers were formally schooled was half that in the adult education group ($P<0.01$). This study shows that socio-economic status is not the determining factor in improving the nutritional status and mothers literacy therefore was the main factor leading to better nourished children in this case.

Although there are a large number of studies showing the importance of female education to child nutrition there are some studies that hold reservation to the extent of this relationship. They believe that the correlation is not strong enough to conclude a causal relationship, if other socio-economic factors are corrected for (Basu 1994; Hobcraft 1993; Kunstadter 1995). In a study conducted by Desai and Alva (1998), the effect of mother's education (primary and secondary) on children's height for age (children 12 to 36 months)[36] was reduced when controlling for family socioeconomic variables. In 6 of 15 countries studied, the coefficient

[34] ENDES is the Peruvian national demographic and health survey.
[35] This is a measurement for the middle arm circumference used to detect malnutrition in children below five years. Low indicates two standard deviations below the reference median
[36] DHS data was used for 15 developing countries from Africa, Asia/North Africa, Latin America/Caribbean.

for primary education was significant and positive and in 13 countries the coefficient for secondary education was significant and positive. However, when variables reflecting family socio-economic background are introduced the effect of maternal education on child height is attenuated. The coefficient for primary education becomes significant in only 4 countries and for secondary education it becomes significant for 5 countries.[37] While this study highlights the importance of other factors as the presence of water and sanitation to improved child height and the lack of evidence for a causal relationship between female education and child malnutrition, it does not dispute the importance of the relationship of mother's education to child nutrition.
In conclusion, although evidence from literature can not show a causal relationship between the mother's education and child malnutrition there is evidence of a strong relationship. Mothers education seems to mostly impact on the child's chronic nutritional status (H/A) with the effect of the mothers education persisting in some of the studies even after controlling for socio-economic conditions.

4.3.2 Female education and Care Practices

This section will explore the relationship between female education with certain care practices and female autonomy using available literature. The care practices that will be discussed include: infant feeding, hygienic behaviors and health seeking behaviors.

a) Infant Feeding Practices

WHO recommends exclusive breastfeeding for the first 6 months after which supplementary food should be initiated (WHO 2001). It would therefore be expected that with better education breastfeeding might last longer but the relationship between maternal education and breastfeeding practices seems not simple. The complexity can be seen in certain studies especially in developing countries, where they may conclude that female education will reduce exclusive breast feeding duration as was found in a study in the Philippines and Malaysia (Barrera 1990 and Da Vanzo et al., 1991). The study in the Philippines showed that better educated mothers weaned their children earlier but in spite of this the children were healthier as indicated by higher height-for-age z-scores. This was explained by the fact that educated mother's had better care practices and were able to provide nutritious substitutes which compensated for the shorter breastfeeding period. Therefore, exclusive breast feeding may benefit uneducated mothers to a larger extent as they lack the required knowledge for giving appropriate substitutes to breast milk. This study however fails to indicate if the educated mother is working or not. If more educated women are working in a formal sector, work may be the influencing factor on breastfeeding as work in a formal wage sector can be incompatible with breastfeeding (Doan and Popkin 1993).
In a study in rural Bangladesh the relationship between maternal education and infant feeding was shown to be mostly positive with a better nourished child, mediated by better infant feeding practices. The educated mothers were more likely to initiate the infant feedings, give supplementary feeds more frequently and feed with age appropriate utensils promoted by Bangladesh radio messages. The effect of the education on these infant feeding behaviors persisted even when controlling for household wealth (Guldan G et al. 1993).
In another study, in the capital city of Ghana, Accra, Armar-Klemesu et al. (2000), maternal education was shown to be a crucial asset for good care giving practices related to child

[37] A limitation of this study is the use of data for living children. As maternal education affects child survival probability the sample of living children over represents children of educated mothers, leading to underestimation of the effect of maternal education.

feeding in children less than 3 years. Limited household resources[38] did not appear to limit the mother's ability to feed her children appropriately provided she was educated.

b) Hygienic practices:

Mother's education is believed to play a role in a cleaner environment for the family and better hygiene in the household. Evidence from several developing countries has shown this association.

In Nicaragua (Gorter et al. 1998), female education (more than 3 years of primary schooling) together with the presence of a radio lead to better hygiene practices[39] with less incidence of diarrhea in comparison to education alone and in comparison to women with less than three years schooling with a radio. This indicates that educated mothers may use health knowledge received through the radio more effectively leading to a better hygienic environment.

In the Armar-Klemesu (2000) study in Accra, maternal schooling was also related to better hygiene behaviors as child cleanliness, maternal cleanliness and keeping water sources covered although limited household resources were constraints to this relationship. When income and other child, maternal and household characteristics are kept constant maternal education was strongly and positively associated with better hygiene practice (Armar-Klemesu 2000).

Barrera's study in the Philippines[40] also showed that mother's education had a significant association with better hygiene for children in 0-2 age group (Barrera 1990). Better educated mothers, having more information and skills, are more able to protect their children against an unhealthy environment.

c) Health seeking behaviors

Health seeking behaviors can be for either preventive or curative purposes. Preventive health seeking behaviors include, ante-natal care and immunization of children while curative health seeking behavior implies taking the child for treatment in a health center or home treatment. Globally, educated women are 50% more likely to immunize their children than uneducated women (Herz and Sperling, 2004) thus protecting their children. Educated women are better able to utilize what is available in the community to their advantage (Barrera 1990; Caldwell 1990; Goodburn, Ebrahim, and Senapati 1990); and educated women may be able to make independent decisions regarding their own and their children's health leading to greater utilization of modern health facilities (Caldwell 1979; Caldwell 1986). Armar-Klemsu et al. (2000) also showed a positive association between maternal education and health seeking behavior which was strong and positive even when controlling for socioeconomic conditions. Joshi (1994), showed that the women with some schooling in a rural village in Nepal, where more likely to use antenatal care than women with no schooling even though antenatal care was available in the village and free. Barrera (1990) also showed that better educated women utilized health facilities more effectively, leading to a larger benefit for their children in comparison to children of less schooled mothers. However, the economic endowment of the mother may influence these results as the direct costs and opportunity costs for women of low socio-economic status may be limiting their ability to go to the health facilities.

Govindasamy and Ramesh (1997) studied the relationship between health seeking behavior and maternal education in North and South India , using the National Family Health Survey, and found that children of mothers with at least a middle-school education are 62 percent and

[38] Such as low income, poor housing quality, few assets, limited access to water, sanitation and garbage collection services as well as other household-level characteristics such as food availability.

[39] Washing of hands, domestic cleanliness (kitchen, living room, yard) and the use of a diaper/ underclothes by the child.

[40] The role of maternal schooling and its interaction with public health programs in child health production.

45 percent more likely to be taken to a health facility for treatment of acute respiratory tract infection (ARI) and diarrhea, respectively, than children of illiterate mothers. As for treatment of diarrhea, mothers with at least middle school education were two and a half times more likely to give Oral Rehydration Salts (ORS) than illiterate mothers. While for fully vaccinating their children, educated mothers were more than four times more likely to vaccinate fully than illiterate mothers. The same positive association was shown in multivariate analysis of the effect of maternal education (at least a middle school education) on antenatal care. Mothers with at least middle schooling were nearly eight times as likely to receive antenatal care for their delivery as illiterate women and literate women with less than middle schooling were more than three times as likely to receive antenatal care as illiterate women. Although socioeconomic factors can be significant and important to health care seeking, this study showed that female education by itself has the strongest impact on health care seeking.

4.3.3 Female education and autonomy

Education gives to women and girls a basic confidence in their abilities and rights, ability to get information and use it properly, and the ability to work and gain income (Jellema A and Unterhalter E 2005). As a result of the education, women may gain greater bargaining power in household decisions and personal relationships which may lead to increased allocation of household resources to child health, schooling and nutrition leading to better care practices (Thomas 1990, Herz and Sperling 2004).

There is evidence suggesting that the number of children born to a woman is inversely related to her level of education (Borooah V.K, 2002). Literate women have been shown to reduce fertility by delaying age of marriage and using contraceptives. Education makes them more receptive to the idea of birth control and more able to access health facilities to receive the contraceptives. Goodburn et al. 1990 showed that educated mothers in the rural parts of west Bengal had better nourished children and a smaller family size. Therefore, if educated women are more able to reduce their family size we can assume that education infers to them some sort of autonomy.

Although schooling can improve bargaining power of females, studies have shown that in order to get significant improvements in female autonomy there needs to be a minimum threshold of education of more than 5 to 6 years particularly in highly gender stratified societies (Jejeebhoy, 1995 as cited by Velkoff V 1998).

4.3.4 Possible pathways for how education enables mothers to improve care behaviors

Female education improves the nutritional status of children through improvement of care practices. The possible pathways that allow educated mothers to improve the care practices include: the ability to acquire skills, ability to process information and the ability to model behavior (Engle P. et al. 1999) (see Annex 11).

1. **The acquisition of literacy and skills**
   This pathway suggests that woman gain the skill of literacy as well as other knowledge from schools which allows her to make better use of health care services, interact effectively and confidently with doctors and nurses and follow treatment recommendations adequately. Women educated through schools also have a knowledge

base to guide behavior and are better equipped to interact with the modern bureaucracies (Joshi, 1994; LeVine et al., 1991) .

2. **Processing of information**
   This pathway suggests that educated women are more able to acquire new knowledge and to process it appropriately. Information processing can be measured by reading newspapers, listening to the radio, watching television and retaining this information. Thomas, Strauss and Henriques (1990) and Barrera (1990) stated that educated women being more knowledgeable are better able to use health care facilities, keep their environment cleaner and thus benefit her children.
3. **Identity acquisition**
   This pathway states that there is a behavior change from going to school resulting from interaction with the 'modern sector' (Joshi, 1994). Caldwell goes further to saying that it is not the learning of facts of in school but going through the years of schooling that leads to this identity acquisition. Educated mothers become cleaner because educated people are believed to be cleaner and not due to the knowledge that cleaning kills the bacteria (Caldwell 1989). Women who are educated internalize teacher-pupil relationship, using it in later life to take on the role of teacher in their households to teach their children and to take on the role of students in the learning and responding to radio advertisements or physicians instructions (Joshi A 1994).

4.4 Education and child malnutrition in Yemen

This section will first look at the prevalence in Yemen of child malnutrition in relation to the level of education of the mother followed by analysis of the relationship between mother's education and child care practices as well as maternal autonomy using the DMCHS 1997. Although socioeconomic factors were not controlled for in the following analysis, some of the studies have shown that even when controlling for socioeconomic factors the impact of education remained significant for the child caring practices.

4.4.1 Female educational level and child nutritional status

The analysis of the association between education and malnutrition indicators in Yemen (see Table 5) shows that for moderate stunting, children of illiterate mothers (54%) are almost three times as likely to be moderately stunted as children whose mothers have completed secondary or higher education (19%). For moderate underweight, children of illiterate mothers (46%) are more than twice as likely to be moderately underweight as children of mothers with secondary complete or higher (19%) (see Table 5). For moderate wasting, children of illiterate mothers (13%) are almost twice as likely to be moderately wasted as children of mothers with secondary complete or higher (8%). In general, we can say that the prevalence of stunting, underweight and wasting among under fives in Yemen is decreasing with increasing level of maternal education. Exceptions can be seen for wasting were children of preparatory complete mothers do not have a reduction in the prevalence of wasting from children with primary complete mothers. This can be expected for wasting as education may not be able to change the consequence of acute food deficiency significantly.

Table 5: Nutritional status of under five children by level of mother's education

	Height-for-age	Weight-for-height	Weight-for-age

Mother's education	% below -3 SD	% below -2 SD[41]	% below -3 SD	% below -2 SD	% below -3 SD	% below -2 SD
Illiterate	28.9	54.3	2.7	13.4	15.5	48.5
Literate	21.0	47.0	2.9	12.7	15.0	39.5
Primary complete	16.5	41.6	2.2	9.3	7.6	36.1
Preparatory complete	12.7	30.5	2.2	10.6	6.3	34.2
Secondary complete+	6.0	18.7	0.8	7.6	3.1	19.2

Source: DMCHS 1997

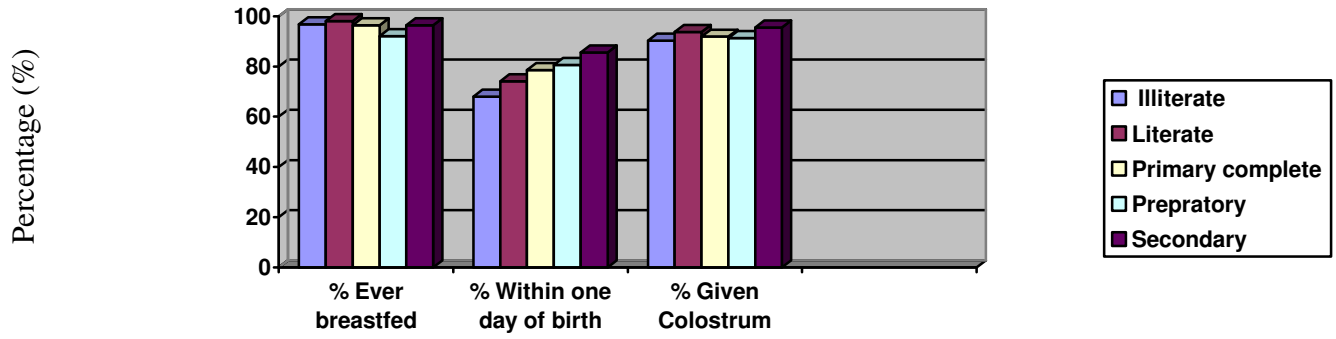
4.4.2 Female education and care practices in Yemen

The role that education plays in child nutrition in Yemen will be analyzed by examining the association between mother's education and infant care practices as infant feeding, hygiene behaviors, and health seeking behavior as well as analyzing the role of education to female autonomy by using the Demographic and Maternal and Child Health survey of 1997..These associations have to be observed with caution as confounding factors were not corrected for.

a) Infant Feeding Practices

Regarding breast feeding in Yemen, Figure 5, shows that the percentage of ever breastfed infants is similar for both educated and non educated women (around 97%). However, Mothers who completed secondary education are almost 20% more likely to breastfeed within one day of birth than illiterate mothers but they are only 5% more likely to give their children colostrum than illiterate mothers. .

Figure 5: Percentage of children* ever breastfed, breast fed within one day of birth and percentage of children given colostrum, according to Mother's educational level in Yemen



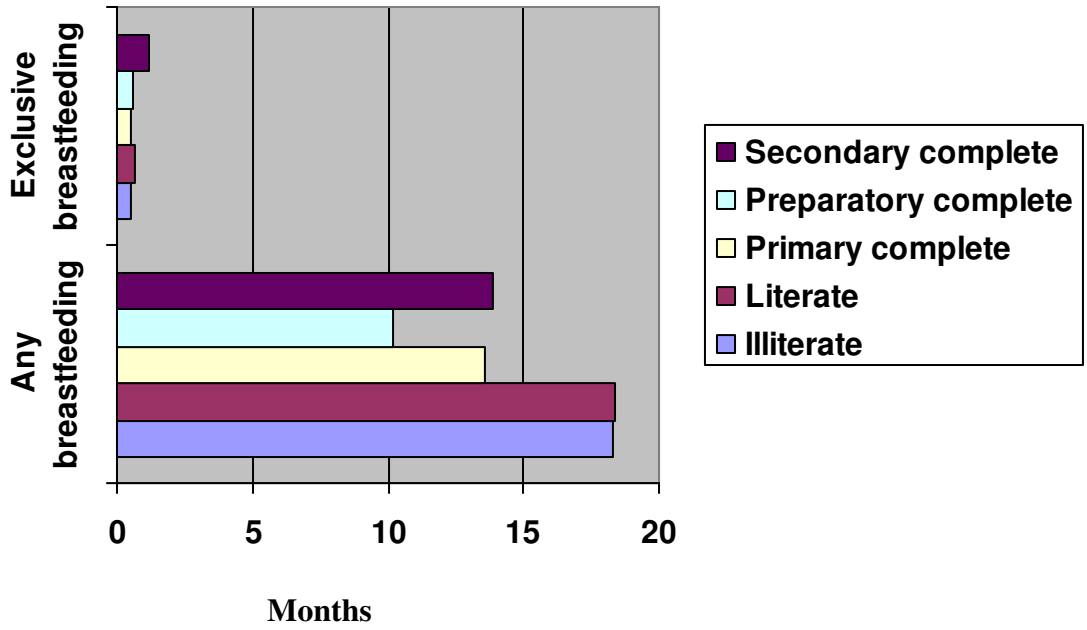
Source: DMCHS 1997
* For children born 5 years preceding the survey

When looking at the duration of any breastfeeding (see Figure 6), illiterate and literate mothers' breast feed longer than mothers with formal schooling. For illiterate and literate

[41] Includes children below -3 SD also.

mothers duration of breastfeeding is about 18.3 and 18.4 months respectively while mothers with primary complete, preparatory complete and secondary complete or more breastfeed for 13.6, 10.2 and 13.9 months respectively.
Although duration of exclusive breast feeding in Yemen is low for all educational levels (see Figure 6), Mothers with secondary complete education breastfeed exclusively more than twice as long (1.2 months) as illiterate mothers (0.5 months). The low duration of exclusive breastfeeding among all mothers may be explained by traditional beliefs that milk is not sufficient for the baby. A possible explanation for the longer duration of exclusive breast feeding in Mothers with secondary complete education may be that they are less likely to succumb to these traditional beliefs.

Figure 6: Median duration in months of, any breastfeeding and exclusive breastfeeding* according to mother's education.



Source: DMCHS 1997
*Exclusive breastfeeding implies only breast milk without the addition of water or any foods.

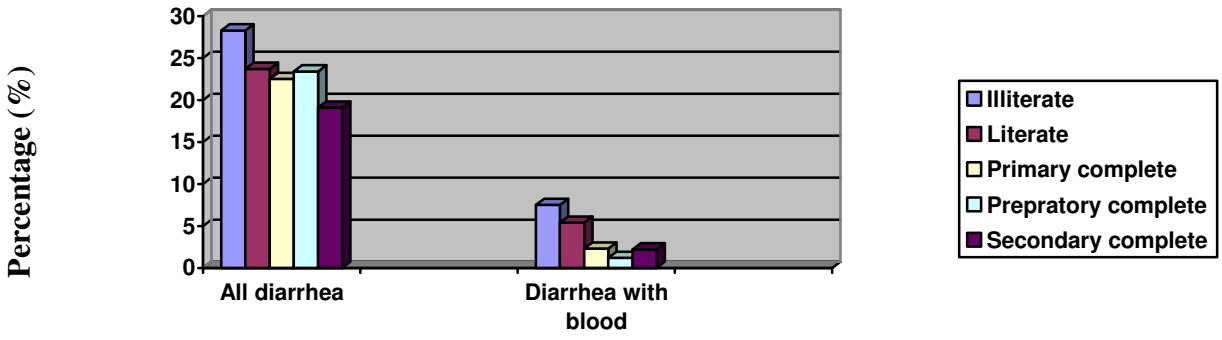
Regarding complementary feeding, 68.3% of children 6-9 months of age start complementary foods in addition to breast milk in Mothers with secondary education complete in comparison to 57.1% of children of illiterate mothers. The difference is not significant between illiterate mothers and mothers with education below secondary complete.

b) Hygiene Practices

Childhood diarrhea is a leading cause of morbidity and mortality in Yemen as it is in most developing countries and hygiene practices are associated with diarrheal disease (Ghosh et al., 1997). Due to the lack of relevant literature on hygiene practices in Yemen, the association between maternal education and hygiene practices in Yemen will be analyzed using the percentage of children under five with diarrhea in the preceding 2 weeks of the DMCHS survey (1997).
The prevalence of all diarrheas in children is 28% and is much higher than diarrhea with blood (7%) (see Figure 7). The prevalence of all diarrheas is seen to decrease with increased education of the mother. Children of illiterate mothers is 28% and decreases to reach a

prevalence of 24% in literate mothers, while for secondary complete mothers this figure goes further down to reach a prevalence of 19%.

Figure 7: Prevalence of diarrhea in under fives in relation to mother's education



Source; DMCHS 1997

c) Health Seeking Behavior

Ante-Natal Care:
Antenatal care (ANC) is part of the care process where mothers seek health services to improve the chance that her newborn will be healthy and of normal weight. In Yemen the majority of mothers (65%) do not receive ANC. Only 34% received ANC from trained medical staff. [42] Women with secondary complete education were much more likely to receive ANC from trained medical staff than illiterate mothers (87% versus 29%).
Total Percentage of mothers with 4 or more ANC visits is only 11.4% (30.7% were from urban areas whereas only 5.7% were from the rural areas). Only 7.6% of the illiterate mothers receive four or more ANC while 56.8% of women with secondary complete will receive the four visits.

Tetanus toxoid injection:
Two tetanus toxoid injections are recommended for pregnant women to prevent the development of neonatal tetanus in infants. Receiving these two doses of toxoid injections will be considered as another proxy for health seeking behavior in women. The DMCHS 1997 shows that only 9% of females receive two doses or more of these toxoids. From these women only 7% of illiterate mothers receive the vaccine. With literacy this figure reaches 15% and continues to increase with increasing female education to reach about 34% in mothers with secondary complete education.

Child Vaccinations:

[42]Trained medical staff includes both doctor and nurse/trained midwife.

There seems to be an association between the level of maternal education and child vaccination. For BCG, 48.8% of children of illiterate mothers in comparison to 87.9% of secondary complete mothers receive this vaccine. For the first dose of DPT the figure is 48.8% versus 86%. For Polio 3 children of secondary complete mothers are almost twice as likely to receive this vaccine as children of illiterate mothers (79.2% versus 42.6%). For measles vaccine this figure is 37.8% versus 80.4% for children of illiterate and secondary complete mothers respectively. The Children of mothers with primary complete have about twice the chance of being vaccinated with all the main vaccines[43] than children of illiterate mothers (24% versus 49.6%). For mothers with secondary or higher education, their children have about three times (70.8%) more chance of being vaccinated than children of illiterate mothers (24%).

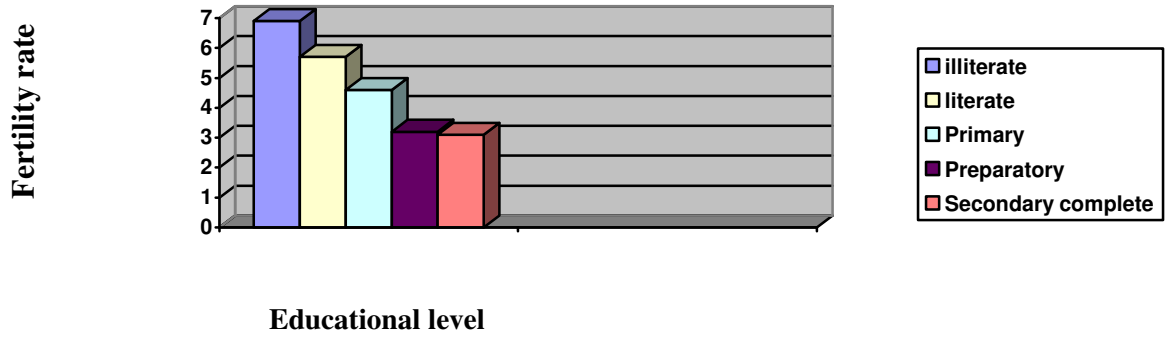
Child illnesses:
The percentage of children with cough and rapid breathing taken to a health facility or to a health provider in relation to Mothers level of education showed that about 48% of children of mothers with primary complete and 59% of children of secondary complete mothers were taken to a health facility or provider while only 30% of children of illiterate mothers were taken to a health facility.
More Mothers with primary and secondary complete know about O.R.S (92% and 98% respectively) than illiterate mothers (72%). For the need to increase the fluids in case of diarrhea, 66% of primary and 90% of secondary complete mothers believe that children should be given more liquids while only about 40% of illiterate mothers believed that more liquids should be given. Therefore, with increase in the level of mother's education, more appropriate health seeking behavior is seen in case of respiratory illness as well as more appropriate drinking practices during diarrheal episodes.

4.4.3 Female education and autonomy in Yemen

As stated previously, the use of any modern contraceptive method[44] is used here as a proxy for female autonomy as well as reduced fertility rate.
Regarding knowledge of modern contraceptives, a total of 79% of married women know a modern method. According to women's educational level, about 76% of illiterate women know a modern method compared with 93% of primary complete and 98% of secondary complete mothers. Although 79% know a modern contraceptive only about 10% of Yemeni women use any modern contraceptive method. The percentage of women using a modern contraceptive in relation to educational level shows that, 8% are illiterate, 16% are literate, 19% are primary and preparatory complete and 31% are secondary complete. These figures indicate that women with secondary complete are about four times more likely to use modern contraceptive methods than illiterate mothers.
Regarding fertility rate, (see Figure 8) illiterate mothers have a fertility rate of 6.9 in comparison to 4.6 and 3.1 for primary and secondary complete respectively indicating that the more educated the women the less number of children she will conceive. This fertility rate in educated mothers reflects on the mother's ability to successfully use contraceptives.

[43]All vaccines include: BCG, measles, and three doses of DPT and Polio vaccines (excluding Polio 0)
[44]Modern contraceptives includes pill, intrauterine device, injection, vaginal methods (diaphragm, foam, jelly), condom, female sterilization, male sterilization and implants.

Figure 8: Fertility rate according to educational level in women 15- 49 years of age*



Source: DMCHS 1997
*Three years preceding the survey

Although education of the Yemeni mother was shown to positively affect the child care practices, caution in interpreting the results is needed as it was not possible to correct for socioeconomic factors in the scope of this thesis. However, certain studies (Govindasamy et al. 1997, Armar-Klemesu et al 2000) have shown that even after controlling for socioeconomic factors, the positive correlation between child care practices and female education persists. Further research may be needed to reveal the strength of this association.

Chapter 5: Intervention programs

This chapter will discuss some of the intervention programs to improve female education in developing countries. The feasibility of these programs in Yemen will be discussed using the SWOT analysis. The intervention programs are directed at both adult and school age females. Interventions directed at adults include literacy campaigns and nutritional education, while those directed at young female will include interventions improving female school enrollment.

5.1 Improving maternal literacy and Nutritional knowledge

Maternal literacy programs including nutritional education as well as communication for behavioral change will be discussed in the following sections.

5.1.1 Literacy campaigns

Empowering mothers with the ability to read has been shown to improve their child's nutritional status and health, as discussed previously (Sandiford P et al., 1995). In a study in Colombia, Lomperis concluded that teaching mothers from developing countries to read will hold the greatest promise of permanently improving the nutritional status among children in preschool. He also concluded that for chronic malnutrition, literacy programs would be a more cost effective strategy and last a life time than food transfer approaches (Lomperis AM 1991). An example of an intervention plan to reduce malnutrition in rural Iran involved a literacy program for the rural women and resulted in a 10% increase in the number of literate women. This literacy program was thought to have played an important role in malnutrition reduction among the children in the region (Sheikholeslam R et al 2004).
The duration of teaching recommended for women to have some form of basic mastery is about 400 hours (Oxenham et al., 2002), but continued literacy practice is required to avoid loss, over the years, of what was learned (UNESCO 2005). Literacy classes usually last around 9 months. Basic costs for good quality literacy programs include costs for start up, training, learning materials, salaries and operating costs. The average cost per 'successful learner' (one having completed the program) can range from US$32 in Asia to US$ 83 in Latin America. Although the costs can be reduced by using volunteer teachers, it has been shown that this leads to a high turnover of teachers leading to poor quality of teaching. Promoting women to participate in literacy programs and to complete the course may be a challenge. The dropout rate for women attending these courses can be very high and an increase in participation may require the addition of other courses to the literacy campaign as sewing and embroidery which may further increase the costs. In Algeria the introduction of courses for sewing, embroidery and hair styling increased the number of women participating from rural areas (Hammoud H 2006). Partnerships with organizations are therefore crucial to cover the costs in developing countries (UNESCO 2006).
According to UNESCO, sustained political commitment plays an important role in the success of mass literacy campaigns in addition to well coordinated partnerships with other organizations. These partnerships which can be vital to the success of the programs, may involve international organizations, NGOs, religious groups, trade unions, private companies,

universities, the media and local authorities (UNESCO 2006). The literacy programs require adequate monitoring, supervision and evaluation systems to determine the outcome factors which may necessitate changes to the program (World Bank 2003).
Although Literacy programs are available in Yemen, published information for evaluation of these programs is hardly found.

S.W.O.T analysis of literacy programs

The strength of literacy programs can include their ability to reach rural women as well as girls who have dropped out from school as these programs are usually set within the community. The design of the program can be suited to what is more feasible for the women and girls in relation to timing for the lessons. The program can bring about increased solidarity between the women and provide job opportunities for them. If nutritional education is added to the literacy program this can also be considered a strength whereas if it is not included nutritional education can be considered an opportunity.
The weakness of such a program includes the lack of qualified teachers in the rural areas to teach, lack of proper monitoring system for assessment of the program, the relatively long hours needed to achieve literacy as well as the cost. The opportunities include the presence of a national strategy for "education for all" which will help in promoting these programs at the government level. Islamic religion which promotes education can be used to convince families to enroll female members. There is also a number of NGOs working on improving literacy in Yemen. Threats to literacy programs include inadequate financial aid from the government and international donors threatening the sustainability of the program.[45]Other threats include the conservative attitudes of the families which may prevent women from attending, as well as the general belief that education is not important for women. The agriculture work time in the harvest season may threaten the program during that time.

5.1.2 Nutritional Education

Nutrition education aims to provide mothers and girls the knowledge of good infant feeding practices as exclusive breastfeeding for the first 6 months, appropriate complementary feeding, balancing and diversifying diet and food groups, having a healthy and hygienic environment. This section will discuss nutritional educational directed to females. Two main programs, the hearth model as well as the Integrated Management of Childhood Illness (IMCI), will be discussed as a means to provide this nutritional education.

a) Communication for behavioral change "the Hearth Model"

One of the main strategies for improving child nutrition is communication for behavioral change (CBC). It has been shown to have a positive impact on complementary feeding practices and is based on social marketing.[46] One type of this program is the hearth model which has been implemented in Haiti, Viet Nam and Bangladesh. This model is part of a comprehensive program that includes, in addition to nutrition education, growth monitoring, deworming, vitamin A and iron supplementation, and treatment for infectious diseases. The hearth model uses the positive deviance-approach where a mother with a healthy, well nourished child, in the same community and with the same socio-economic condition volunteers to show other mothers how she feeds and cares for her child. The duration of this

[45]In most developing countries literacy programmes receive only 1% of the total national education budget (UNESCO 2006).
[46]Social Markiting is when the beneficiaries see that this programme will fill their own aspirations and wellbeing.

program is around 2 weeks and it takes about 6 to 12 months to complete rehabilitation of most malnourished children in the community. In Vietnam the cost of this program was around US$2 per child. The impact of this program was formally evaluated in Haiti and Vietnam. In Haiti there was an improvement in weight in children using this intervention in comparison to children not in the program. While in Vietnam this program, during a two year period, decreased the level of severe underweight from 23% to 6% and this improvement in weight continued even after the sessions were discontinued implying long term improvement in child feeding and care giving practices (Sternin M et al 1997).
In Peru, nutrition education programs (complementary feeding demonstrations and growth monitoring sessions targeting children below 2 years of age) showed a positive impact on the children's nutritional status as well as an impact on the use of health facilities. Children in the intervention program made 3.5 more visits to the health facilities than the control group in the first 18 months. The intervention prevented 11.1 cases per 100 children from stunting. The marginal cost of this intervention is $6.12 per child reached (Waters et al. 2006), and depending on the intensity of the nutrition education program, costs can range from US$2 to US$10 per child (Fiedler 2003 as cited by Waters et al. 2006).

b) Integrated Management of Childhood Illness

The UNICEF's Integrated Management of Childhood Illness (IMCI) program, an initiative made to improve local health systems and community practices, has been used to provide nutritional education with behavioral change (through its nutrition component) in various developing countries including Yemen. In Yemen it is available in 97% of the governorates but it covers only 12% of under fives. Although, evaluation of this program is important to determine its success, published material on its evaluation was not found. But The success of the nutrition counseling of the IMCI program has been seen in Pelotas, Brazil where physicians, trained in providing nutritional education, counseled caregivers on improved feeding practices at the health centers. The mothers receiving this information from the trained physicians showed higher rates of recalling the messages on specific foods and feeding practices and food preparation in comparison to those receiving information from non trained physicians. This resulted in significantly improved anthropometric status of children aged 12 to 24 months (Pelto et al.2004).

S.W.O.T analysis of Nutritional Education Programs

The strengths of the hearth model are that mothers will receive nutritional education from women within their community, and be able to use locally available and affordable foods, which will make the program more acceptable to the mothers. It can reach women in remote areas. Other strengths include the short duration of the program and community mobilization. Sustainability is more likely in this program as solutions to nutrition problems are based on locally available resources. All siblings can benefit from the mothers acquired knowledge. Cost effectiveness is another important strength. For IMCI program an important strength is its availability in almost all governorates.
The weakness of the hearth model for nutritional education is that it requires women volunteers who are literate and have the time to volunteer for educating mothers while there is a lack of women willing to volunteer in rural areas as they are busy in agricultural work. The weakness of the IMCI program is its low coverage rate for under fives as well as the lack of trained health personnel in nutritional education. Also, Mother's must travel to a health center to receive nutritional education through the IMCI; therefore, this will limit the education to women who are able to reach the health center.

Opportunities would be the commitment of Yemen and international organizations to the MDGs goal to reduce prevalence of underweight in children under five years of age by the year 2015. For IMCI nutrition education, it can be given during child immunization days. One main threat to this program is the culturally widespread notion in Yemen of the "evil eye"[47] which may limit the ability of the program to examine children of positive deviant families.

5.2 Improvement of Girl's Enrolment in School

Interventions promoting girls enrollment in school are many and may include awareness raising programs on the importance of girls education, improving school infrastructure to make schools more culturally acceptable and safe, reducing direct cost of girls schooling by school fee waiving, scholarship schemes, and also reducing opportunity costs by school feeding programs with a take home ration. However, in this section the interventions analyzed to improve girls enrollment will include school fee wavering, scholarship schemes and school feeding programs.

5.2.1 School Fee Waiving

School fee waiving and scholarship schemes can be a factor in reducing the direct costs to girls schooling. Some countries have eliminated school fees with some success in increasing girl's enrollment. For example in Malawi, Uganda, Tanzania and Kenya abolishing school fees resulted in increased enrollment. In Kenya, enrollment of boys and girls increased by 1.3 million after the abolition of fees in 2003 while in Uganda, enrollment increased from 2.5 million in 1997 to 6.5 million in 2000 after removal of school fees (Dervarics C 2004) . But with the increase of student enrollment, problems of reduced school quality arose due to overcrowded classrooms, insufficient school supplies and teachers (UNICEF 2006).

5.2.2 Scholarship schemes

Interventions with scholarship schemes can increase girl's enrollment as well as reduce girl's dropout as seen by the following example in Bangladesh. The female secondary school stipend program in Bangladesh started in 1982. This program which promotes school over early marriage, gave a stipend to secondary school girls (grade 6 to 10). Girls receive an allowance if they have a 75 percent or better attendance rate, post high exam scores, and stay unmarried. In the first program evaluation an increase in girls enrollment from 27% - 44% in the pilot areas was shown. And in 1992, after nationwide elimination of girl's tuition fees with expansion of the stipend program in all rural areas, the girls enrollment further increased to reach 48%. In addition this program also included an awareness raising campaign that emphasizes the value of schooling in a manner that shifts the stigma away from having an adolescent child in school toward not having one in school. This program has shown long-term success with girls delaying marriage and getting jobs after leaving school. (King E and Alderman H.2001).

5.2.3 School Feeding Programs

[47] The evil eye is the belief that some people can harm the child who is healthy simply by looking at them and result in their becoming ill. To counteract this some believe that certain verses from the Korean should be recited.

School feeding programs (SFPs) can address both the nutritional and educational aspect for short term and long term effects. Short term effects may include increased enrollment rate for girls, improvement of their learning performance and health and nutrition. While long term effects may include poverty reduction, improvement in food security and reductions in educational gender inequalities.

School feeding, by providing breakfast has been shown to have the strongest positive effect on children's class performance although the effect on nutritional status or enrolment is less obvious when comparing between the provision of breakfast, snack or lunch (Del Rosso JM 1999). SFPs may lead to substitution were girls provided with school meals consume less food at home. This substitution is seen less when the school meal is given at breakfast rather than at lunch (ibid). SFP may also provide take-home rations of food in return for girls attending school. The take home ration can be used for the whole family encouraging families to send their daughters to school and to keep them there. Foods provided for school feeding which are locally produced stimulate local agriculture production; avoid dependency on foreign foods as biscuits, and boost local food security. The foods usually provide between 25% and 50% of the daily requirements for macronutrients (carbohydrates, fats, proteins) and when micronutrients are added, it is aimed to provide 100% of the daily requirements of micronutrients (Del Rosso JM 1999, WFP/UNESCO 1999).

Evidence on the success of this type of program has been shown in several developing countries which have similar situations to Yemen in respect to low female education and high childhood malnutrition in rural areas.
In **Pakistan** , the ratio of male to female school enrollment is 1.5 to 1 and this ratio is much higher in certain provinces as Balochistan and North West Frontier Province (NWFP) were the ratio of school enrollment can reach 6 boys to 1 girl. SFP was started in these two provinces in which food was given for families in return for taking girls to school. Between 1994 and 1998 enrollment was increased 247% for girls. Both the student attendance and dropout rates were also positively affected (WFP/UNESCO 1999).
Morocco , another developing country with only 52% of girls attending primary school in rural areas in comparison to 72% of boys, and where 4 out of 10 girls drop out of school before reaching grade 5, has had some success with a take home ration. Even though the World Food Program has assisted Morocco since the 1970s with the SFP, feeding at school only with no take home rations seemed not to be successful. Therefore the WFP adopted a take home ration SFP[48] for rural areas. During a two year period of this program female enrollment in the first grade doubled in assisted schools and one province showed a four times increase in girl's enrollment in primary school. In addition people's views on girl's education had become more favorable (UNESCO/WFP 2000). Targeting to allocate limited resources in developing countries is very important. In the case of Gambia, the program failed to be sustainable because it aimed at universal coverage (King J, Del Rosso JM. 1994).

SWOT analysis of programs increasing female school enrollment

The strengths of the school fee waiving, scholarship schemes and school feeding programs is the reduction in direct costs for female education and reducing the gender disparities in schools. In addition the opportunity costs are also reduced in the scholarship schemes and SFPs as money and food respectively is given in return for the girls schooling. These

[48]In return for girls attending school regularly the families receive 100 kilograms of wheat and 10 liters of vegetable oil per year distributed in two installments,

programs also reduce dropout of girls from school and increase attendance, reduce the chance of early marriage, promote girls empowerment and raise awareness on the importance of girl's education. Other strengths specific to SFPs include improving learning performance of participating children by counteracting the phenomena of "short term hunger",[49] improving health and nutrition by contributing to a reduction in the prevalence of under nutrition (Nube Maarten, 2005). Take home food rations provide food to all members of the family and may improve household food security. The weakness of these programs is the lack of qualified female teachers, lack of schools in remote areas and poor school infrastructure. The curriculum content may not provide more relevant information for rural girls working in agricultural settings. Even with school fee waiving, costs for girls schooling may still be high due to indirect costs. Opportunities for these programs include the government's implementation of the national basic education development strategy for "education for all", the government's ratification of the convention on the rights of the child as well as the international and governments commitment to the MDGs. The presence in the country of several NGOs can be used to run these programs. The threats to these programs include other barriers to girl's schooling as parental fear for girl's security due to travel to remote schools and lack of adequate facilities as latrines in schools. High cost of program may limit its sustainability if donors stop funding. Corruption among officials providing the stipends and food rations may threaten the sustainability of the program although anti-corruption measures as well as decentralization of programs may control this threat.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

[49]Short term hunger refers to the hunger that occurs in school children in poor communities who go to school without eating breakfast reducing their ability to concentrate and benefit from school.

Childhood malnutrition is still a major public health problem in Yemen, especially in the rural areas. Female education has been shown in various developing countries to promote better child nutrition. The effect of education has been shown to improve care practices which led to better nourished children of the more educated mothers. Female education is still very low in Yemen due to many factors related to financial, socio-cultural and poor quality of schooling. An association has been shown between the female education and child malnutrition in Yemen. Mother's education positively affected their child's growth. Their education led to better infant feeding practices, hygiene practices, and health seeking behavior as well as increased autonomy as reflected by the proxies studied. As certain interventions involving literacy programs, nutritional education and increasing girls enrollment in schools has been shown to improve the child's nutrition in some of the developing countries, therefore recommendations need to be directed at promoting implementation of similar programs in Yemen.

6.2 Recommendations

In this section recommendations will be provided for increasing nutritional education, female literacy and school enrollment. For all recommendations political commitment is needed for initiation and sustainability of programs related to nutritional education, increasing female literacy and girls' schooling. Good monitoring and evaluation for all programs is also needed to evaluate outcome, impact and cost effectiveness of the programs in Yemen.

1) **Increase nutritional education among females through implementation of the "Hearth Model" and through the IMCI in the rural areas of Yemen**.
    - Implementing a pilot of the "Hearth Model" in one of the rural areas of Yemen showing high childhood malnutrition rate. The pilot will allow program managers to determine if possible threats as the "evil eye" can be overcome.
    - Promoting community involvement and training local community members to perform and run the program. The sense of ownership that comes with community involvement can encourage more people to volunteer and assist in these programs.
    - On the job training IMCI health personnel on nutritional education in order to strengthen the nutritional education given to mothers through this program.
    - Increasing the coverage rate of IMCI to under-fives. This may involve providing an outreach program to reach those women in remote areas who are unable to attend health centers.
    - Promoting partnership and collaboration between NGOs, donors, women's groups and community leaders for implementation of nutritional programs (financing, setting up and for training of women volunteers).
    - Nutrition education should be a part of any educational program (literacy or school).

2) Promote female literacy programs in rural areas of Yemen.

In order to achieve this, the following is recommended:

- Raising awareness of the importance of female literacy and education through Information, Education and Communication. Respected community members may play an important role in this as well as religious leaders who can emphasize the positive view of Islam towards education.
- Building teacher capacity for the program through training of educated females in the local community if possible.

- Promoting community involvement to enhance ownership as well as to determine best time and location for the literacy programs. The programs should not be initiated during harvest season.
- In cooperating income generating skills such as sewing and embroidery in addition to literacy as an incentive to increase female enrollment.

3) - **Improvement of girl's enrolment in schools**

- Reducing costs for girls schooling by implementing school fee waiving, providing school scholarship schemes for girls and by implementing school feeding programs with take home rations in areas showing low girls school enrollment.
- Curriculum content needs to be more gender sensitive to promote the importance of girls schooling.
- Removing distance as a barrier by building small (2 room) local community schools. These schools can be used in shifts of mornings and afternoons to accommodate different grades.
- International donors as well as private businesses should donate more funds for programs promoting girls enrollment in schools, for infrastructure (building small community schools) and for human resource development. This is particularly important as increased female school enrollment necessitates the need for more schools and for training of female teachers to keep up with demand as Yemen has shortage of both teachers and schools.
- Anti corruption measures should be implemented by program managers to reduce corruption.

4) Further research is needed to:

- Determine the extent of child malnutrition specifically in each governorate.
- Provide more recent version of the Demographic Maternal and Child Survey.
- Understand the reasons for the gender disparity in school enrollment in the governorates with the highest and lowest gender disparities (Hajja and Al Mahrah respectively).
- Determine the effect of socio-economic differences on child malnutrition as a possible confounder for female education.
- Describe maternal hygiene behaviors practiced during child care and their relation to mother's education.

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ANNEXES

*ANNEX 1: **Map of Yemen***


45
50
SAUDI ARABIA
20
20
OMAN
Ḥabarūt
Ṣa 'dah
Jabal an Nabi Shu 'ayb
Say' ūn
Aṣ Ṣalīf
SANAA
Al Ghayḍah
Nishtūn
15
Sayhut
15
Red Sea
Al Ḥudaydah
Ibb
Al Mukallā
Arabian Sea
Ta 'izz
ERIT.
Mocha
Abyān
Socotra
Aden
Gulf of Aden
Bab el Mandeb
DJI.
10
10
SOMALIA
ETH.
0 100 200 km
0 100 200 mi
45
50
INDIAN OCEAN

ANNEX 2: Number of Public and Private Health Facilities and Health workers

The latest data available from the MoPHP for 2002 are that there are 15 major hospitals (averaging 337 beds each), 12 small governorate hospitals (averaging 88 beds each), 111 rural and district hospitals (averaging 25 beds each), 614 health centers, 2,028 health units and two tertiary care hospitals[50] (Yemen National Health Accounts, 2006).

Data for private facilities and health workers show that there are: 92 Hospitals, 336 polyclinics, 114 health centers, 534 physicians' clinics, 744 laboratories, and 1,601 pharmacies (MoPHP 2002).

[50] National Health Accounts Team, Republic of Yemen, and Partners for Health Reform*plus*. June 2006. *Yemen National Health Accounts: Estimate for 2003.* Bethesda, MD: The Partners for Health Reform*plus* Project, Abt Associates Inc.

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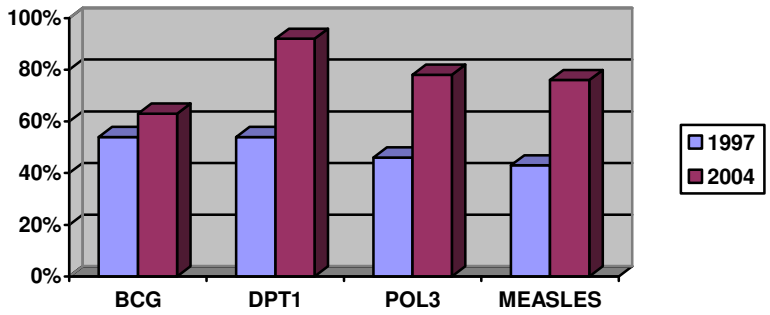
ANNEX 3: Middle East and North Africa Health and Demographic Indicators.

country	infant mortality rate (per 1,000 live births)	*under 5 mortality rate (per 1,000 live births)	Maternal mortality rate (per 100,000 live births)	life expectancy at birth, 1997 (years)		Population growth rate (%)		Total fertility rate (births per women)
	1997	1998	1990-97	males	females	1995	1997-2015	1997
Yemen, Republic	85	121	1,400	53	54	3.2	2.6	6.5
Egypt, Arab Republic	51	69	174	64	66	2.3	1.5	3.2
Morocco	53	70	370	64	68	1.7	1.5	3.5
Syrian Arab Republic	31	32	180	66	70	3.0	2.2	4.0
Iran, Islamic republic	26	33	35	68	71	2.7	1.6	2.8
Jordan	29	36	150	68	72	4.3	2.4	4.2
Algeria	32	40	140	68	71	2.2	2.0	3.6
Tunisia	30	32	139	68	70	1.8	1.3	2.8
West Bank and Gaza	25	…	…	…	…	5.6	3.5	6.0
Lebanon	28	35	300	67	71	1.9	1.3	2.5
Oman	18	18	190	68	73	5.5	2.4	4.8
Saudi Arabia	21	26	18	69	71	3.8	3.1	5.9
United Arab Emirates	8	10	26	73	76	5.0	2.0	3.5
Iraq	112	125	310	59	62	2.1	2.1	4.7
MENA regional Average	34	46	233	67	70	2.4	2.1	4.1

*The results for the under 5 mortality rate were used from UNICEF "The State of the World's Children 2000".

Sources: World Bank estimates, 1999; Yemen Demographic and Maternal and Child Health Survey (YDMCHS), 1997.

ANNEX 4: Coverage rate of main vaccines in Yemen in children 12-23 months old for 1997 and 2004.



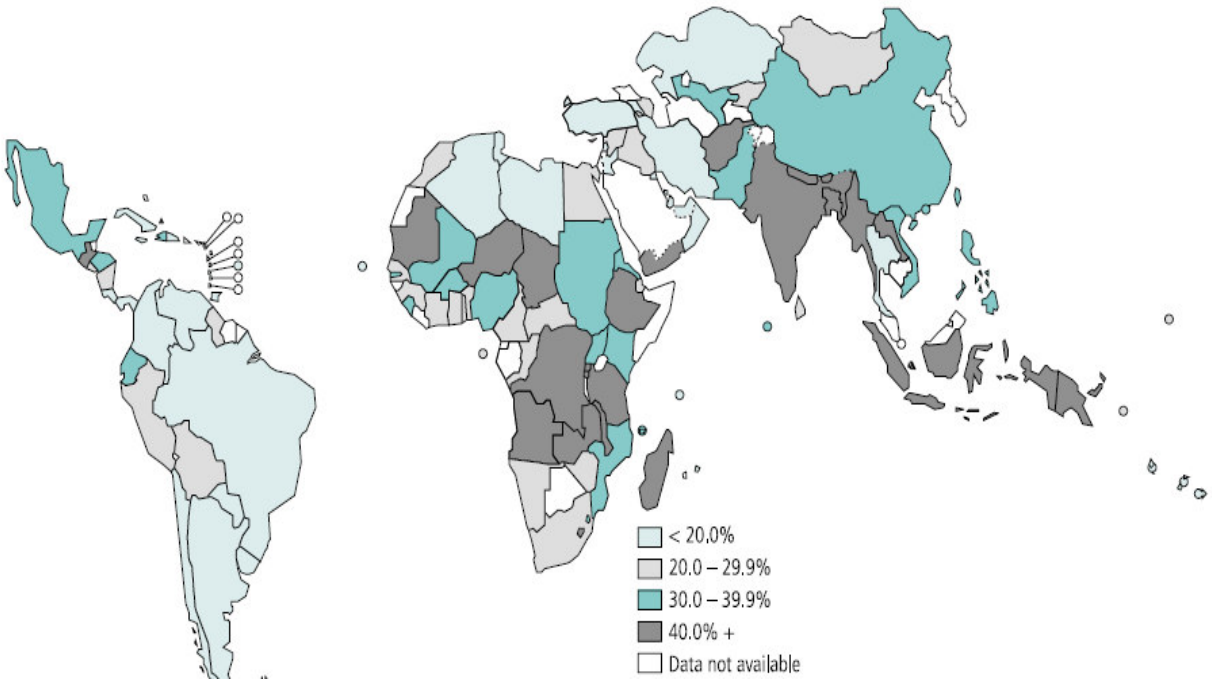
Source: Data for 1997 was taken from DMCHS and data for 2004 was used from estimates of WHO/UNICEF Review of National Immunization Coverage - 25 August, 2005

ANNEX 5: MILLENNIUM DEVELOPMENT GOALS AND NUTRITION

Goal 1. Eradicate extreme poverty and hunger.
Malnutrition erodes human capital, reduces resilience to shocks and reduces productivity (impaired physical and mental capacity).
Goal 2. Achieve universal primary education.
Malnutrition reduces mental capacity. Malnourished children are less likely to enroll in school, or more likely to enroll later. Current hunger and malnutrition reduces school performance.
Goal 3. Promote gender equality and empower women.
Better-nourished girls are more likely to stay in school and to have more control over future choices.
Goal 4. Reduce child mortality.
Malnutrition is directly or indirectly associated with about 60% of all child mortality.
Malnutrition is the main contributor to the burden of disease in the developing world.
Goal 5. Improve maternal health.
Maternal health is compromised by an anti-female bias in allocations of food, health and care.
Malnutrition is associated with most major risk factors for maternal mortality.
Goal 6. Combat HIV/AIDS, malaria, and other diseases.
Malnutrition hastens onset of AIDS among HIV-positive. It also weakens the resistance to infections and reduces malarial survival rates.

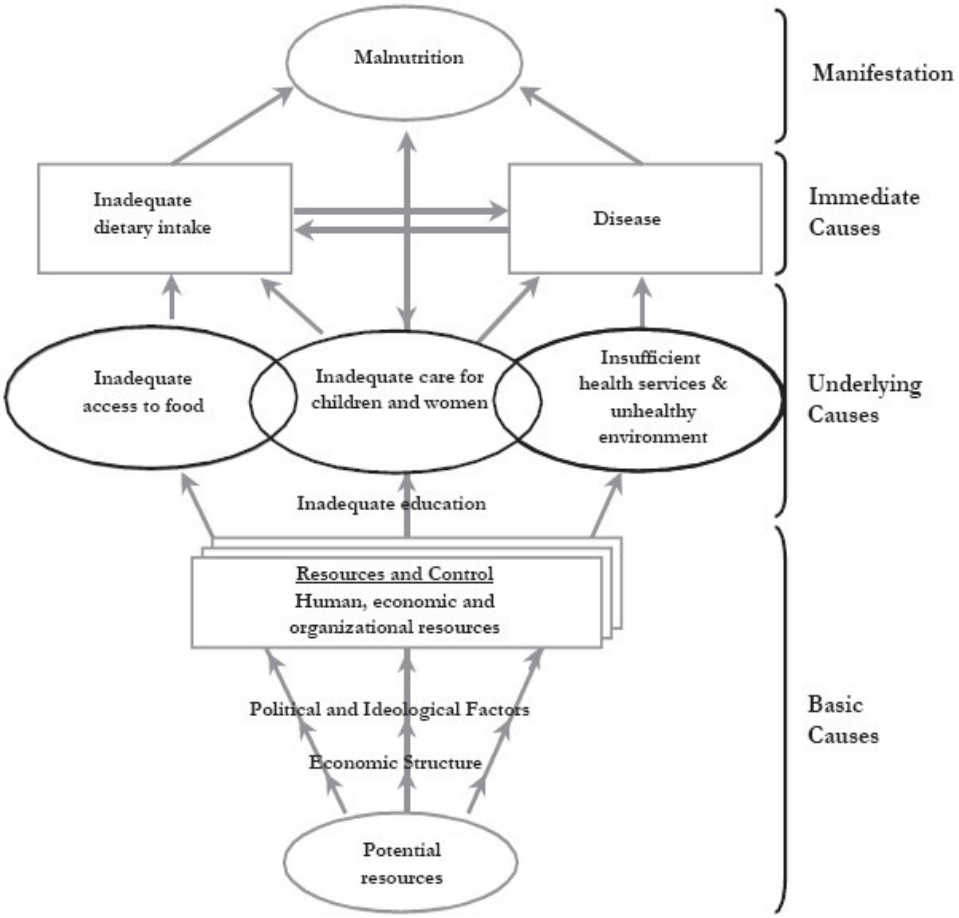
Source: SCN, 5th report on the world nutrition situation 2004 amended for most recent data on the association of malnutrition to child mortality.

ANNEX 6: Prevalence of Stunted Under 5-year old children in developing countries.



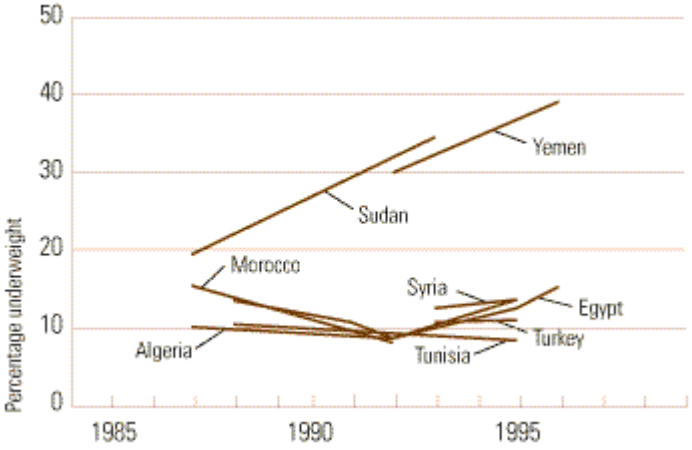
Source: WHO Global database on child growth and malnutrition, 2000.

ANNEX 7: UNICEF Conceptual Framework



Source: SCN, 5th Report on the World Nutrition Situation (adapted from UNICEF (1998), The State of the World's Children 1998. Oxford University Press, Oxford).

ANNEX 8: Trends in child malnutrition (weight-for-age below 2 SD) in the Middle East and North Africa



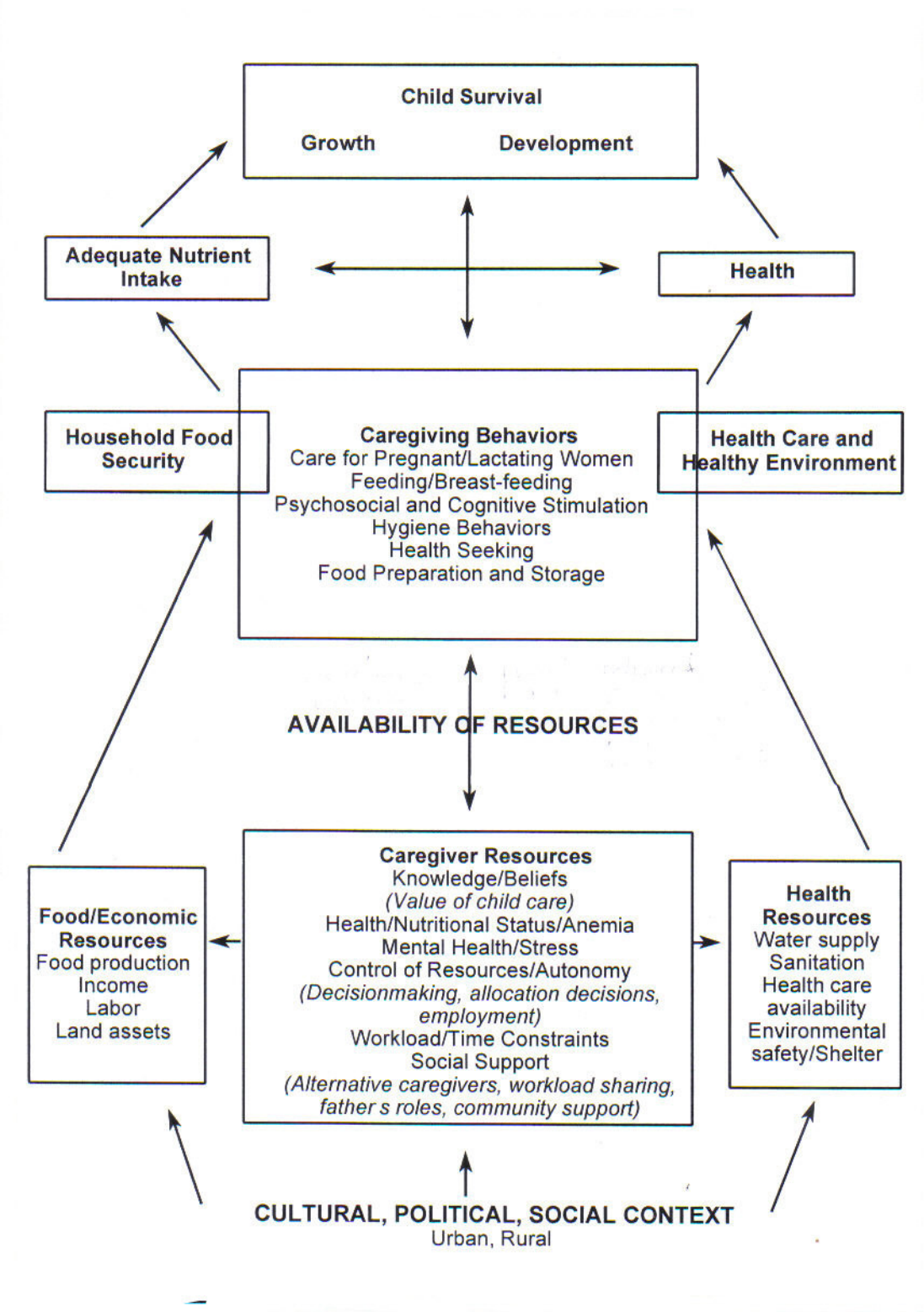
Source: The State of the Worlds Children 1998. Focus on Nutrition UNICEF 1997

ANNEX 9: WHO Classification for Assessing Severity of Malnutrition by Prevalence Ranges among Children Under Five Years of Age.

Indicator	Severity of Malnutrition by prevalence ranges (Percent)			
	Low	Medium	High	very High
Stunting	<20	20-29	30-39	>40
Underweight	<10	10-19	20-29	>30
Wasting	<5	5-9	10-14	>15

Source: WHO 1995

ANNEX 10: The extended model of care



Source: Engle, Lhotska, and Armstrong 1997.

ANNEX 11: Pathways for how education and schooling can lead to good care giving practices