



**USAID**  
FROM THE AMERICAN PEOPLE

## **West African Regional Food for Peace Office USAID/WEST AFRICA Professional Paper Series**

---

June 2008

Series No 6

### **Understanding Child Malnutrition in the Sahel: A Case Study from Goundam Cercle, Timbuktu Region, Mali**

#### **Introduction**

Malnutrition is a major health problem affecting approximately 32% of all children in developing countries (UNICEF, 2004). It is an underlying factor in over 50% of the deaths (equivalent to between 10 and 11 million) of children under 5 years of age who die each year of preventable causes (Steve Collins *et al.* September 2006). According to the 2006 United Nations Consolidated Appeals Process (CAP) for West Africa, an estimated 52% of children's deaths in the region are caused by malnutrition.<sup>1</sup>

The causes of child malnutrition are almost always complex, multidimensional, and interrelated. They may range from factors as pervasive in their impacts as political instability and slow economic growth to those as specific in their manifestations as diarrhea and respiratory infections. The Food and Agriculture of the United Nations groups the causes of malnutrition under four broad categories: food, health, sanitation, and child-care inadequacies.

In West Africa, there are on-going debates about the relative contributions of each of these factors in the high and persistent levels of malnutrition that characterize the region. Until recently, there was a general view that this problem was related primarily to a lack of food in the region. More recently, a consensus is developing that poor water quality, a lack of knowledge of good childcare and child feeding practices, poor health and sanitation service coverage, and childhood diseases play a major role. Many recent studies indicate that current interventions aiming to reduce the prevailing above normal rates of child malnutrition in the West African region have had little impact. These

---

<sup>1</sup> Refer to the FY 2006 USAID Bureau for Democracy, Conflict, and Humanitarian Assistance (DCHA) Sahelian West Africa Malnutrition Situation Report #1.

studies suggest that the causality of these problems has been misunderstood and inappropriate actions have been implemented.

Within the framework of its food security projects in West Africa, USAID's Office of Food for Peace (FFP) is financing many food security programs with child nutrition components. These provide a number of opportunities to try to answer this question. The regional office of FFP in Dakar has therefore chosen to use a case study format to assess the causes of high and persistent malnutrition in the Sahel region and the appropriateness of an intervention that is addressing this problem.

The Goundam Food Security Initiative (GFSI)<sup>2</sup> in Mali, carried out by the international non-governmental organization, Africare, has been chosen as the case study for this purpose. Anthropometric data gathered at various points under this effort were thoroughly analyzed, relevant literature on child nutrition reviewed, and the actions of the initiative considered within this context in order to identify timely and appropriate responses.

### **Regional and National Context**

The Sahel has some of the highest acute child malnutrition rates in the world. According to the latest available surveys conducted in Burkina, Chad, Mali, Mauritania and Niger (UNICEF, 2006), 1.4 million of the under-five children in these countries are suffering from acute malnutrition. Although this rate varies from country to country, the regional prevalence of acute malnutrition is often above the 15%<sup>3</sup> globally-accepted emergency threshold. Curiously, high incidences of malnutrition are not limited to the most food-insecure areas in the Sahel. Extremely high rates are also found in some of the more food secure areas of the region. According to the results of the 2006 Demographic and Health Surveys, the northern regions of Mali - Timbuktu, Gao, and Kidal – where some of the worst food insecurities are found, had chronic child malnutrition rates of 43.9%, 33.5% and 32.6% respectively. However, the main cereal and cotton production regions of the country to the south of these areas had far higher stunting rates of 46 % for the Sikasso region, 39.1% for Koulikoro and 40% for the Segou region. Recent surveys conducted in cities like Niamey and Ouagadougou also show that child malnutrition is not only concentrated in rural areas. In these capital cities, about 16% of the children under-five suffer from acute malnutrition.

In the Sahel, chronic malnutrition in children is generally widespread (Table 1). Thirty-seven per cent of under-fives in the region (i.e., one-in-three, or a total of 3.6 million children) suffer from chronic malnutrition. What is more worrying is that approximately 50% of under-fives are either chronically undernourished, or suffering from severe chronic malnutrition (West Africa 2006 CAP). In Burkina Faso, chronic malnutrition

---

<sup>2</sup> GFSI is a USAID/Office of Food for Peace Title II, non-emergency, Development Assistance Program and, as such, has an overall goal of improving household food security.

<sup>3</sup> According to nutritionists, when the prevalence of acute malnutrition in children over 6-59 months old is > 10% the nutrition situation children needs to be considered as serious ; when it is > 15% the nutrition situation of children needs to be considered critical.

increased from 30% to 39% between 1993-2003. In Niger, the level of stunting among children under-three has gone from 27% in 1992 to 41% in 1998 and 45% in 2006. In Mali during the same period, the rate of stunting increased from 30% to 38%. The underweight prevalence in the region also shows a similar pattern: 30% of children under-five were underweight in 1993 compared to 38% in 2003, which is classified as very high by WHO (West Africa 2006 CAP). Surveys conducted in Chad (UNICEF, 1996-2005) showed similar high levels of childhood malnutrition: stunting (41%), underweight (37%) and wasting (14%) for children under-five. According to UNICEF, about 52% of children's deaths in the Sahel are attributable to malnutrition.

Table 1: Nutritional Status of Children under five in the Sahel and Guinea

Country	Stunting	Underweight	Wasting
Burkina Faso <sup>a</sup>	38.7%	37.7%	18.6%
Chad <sup>b</sup>	40.9%	36.7%	13.5%
Mali <sup>c</sup>	37.7%	26.7%	15.2%
Mauritania <sup>d</sup>	34.5%	31.8%	12.8%
Niger <sup>e</sup>	39.7%	40.1%	13.6%
Senegal <sup>f</sup>	16.3%	17.3%	7.6%
Guinea <sup>g</sup>	35.0%	25.9%	9.0%

Sources: (a) DHS 2003, (b) DHS 2004, (c) DHS 2006, (d) AGSVA – WFP/Mauritania 2005, (e) MICS2 Niger/UNICEF 2001, (f) DHS 2005, (g) DHS 2005

Mali is a developing country in West Africa with a total population of 11,716,829. The majority of its population is comprised of subsistence farmers. A low literacy rate (46.4% overall) and life expectancy (49 years), scarcity of natural resources, poor infrastructure, periodic droughts, frequent locust invasions (most recently in 2004), and lack of highly fertile land are all factors contributing to its rank of 174 out of 177 countries on the UN Development Index. The data presented in Table 2 summarize child malnutrition rate trends in Mali from 1998 to 2005. As shown by these data, stunting has been gradually increasing in Mali since 1988/1989. Starting from a 27% level in 1988/1989, the rate reached 38% in 2000/2001. Since then, it has stabilized. Wasting and underweight rates, on the other hand, have been observed to decrease significantly during the 1988-2001 period, but wasting increased in 2006.

Table 2: Trend of Child malnutrition rates in Mali

Indicators	1988-89(1)	1995-96(1)	2000-01(2)	2005-06 (3)
Stunting (height/age)	27%	30%	38%	38%
Wasting(weight/height)	18%	23%	11%	15%
Undernourished(weight/age)	43%	40%	34%	27%

Source: (1) World Bank Operations Evaluation Department; (2) DHS/Mali 2001 (3) DHS/Mali 2006

## **Project Area Context**

Three child nutrition indicators have been monitored by the GFSI project in the Goundam/Dire area during the last ten years.

### *Child malnutrition Indicators*

The anthropometric measurements of the children are transformed into indices of height-for-age, weight-for-age and weight-for-height z-scores. Thus, by using these z-scores, one can determine the various levels or forms of child malnutrition according to their deviations from the median. For example, anthropometric child measurements of -2 or -3 z-scores indicate moderate and severe child malnutrition, respectively. In other words, children who are less than two SDs to three SDs below the median of the reference population are classified as moderately or severely malnourished.

*Wasting or acute malnutrition* is expressed by the ratio: weight-for-height < -2 SD, and <-3 SD. This anthropometric indicator measures recent weight loss or emaciation which indicates acute malnutrition. Also, it indicates a recent change in nutritional status related to a sudden deprivation of food or negative reaction to nutritive substances that result in fast loss of weight. The strongest prevalence of wasting is observed during the periods of famine, severe seasonal food shortages or during serious illnesses (Jean-Pierre Lachaud). It is the indicator most usually used in Africa for the evaluation of food crisis situations because of the difficulties associated with the uncertainty in establishing the ages of children. In emergencies, the prevalence of acute malnutrition is used as an indicator of the severity of the crisis. The convention is that moderate plus severe wasting rates of 5% to 10% among children indicate a precarious food situation, and the rates between 1% to 20% suggest there is a serious public health problem (Agadez and Tillabéri Food Security Initiative -ATFSI-, Baseline Study July 2007).

*Stunting (delay of growth) or chronic malnutrition* is expressed by a height/age ratio. It translates into a state of nutritional deficiency related to frequent episodes of acute malnutrition or long periods of food deficiency, often combined with a persistent or periodic poor health in the first years of life. This form of malnutrition constitutes a good indicator of the socio-economic development of a community (the structural situation).

*Underweight* is expressed by a weight/age ratio. It indicates a pathological status resulting from the relative or absolute deficiency of one of the most essential nutritive substances and/or calories. The most extreme symptoms of this form of malnutrition are characterized by a severe muscular atrophy resulting from a loss of weight or a delay of growth. This form of malnutrition is relatively sensitive to the fluctuations in the short term access to health. Low weight/age can result from either stunting or wasting.

## **Method**

### *Study area*

Data used in this study were collected during the final evaluation of the GFSI project implemented by Africare in the Goundam and Diré circles in Mali. The study area is located in the northern region of Mali about 1,000 km from the capital city - Bamako.

The population density is less than 2 people per km<sup>2</sup>. The area belongs to the Sahelo-Saharan zone with average rainfall varying between 100 and 300 mm per year. The Goundam area is a zone of recessional farming system around lakes while in the Diré zone, wheat and rice production are practiced using irrigation from the Niger River. Livestock (cattle, sheep and goat) breeding is the second major activity of the population. An important fraction of this population is nomad even if they have started to be sedentary. The Goundam and Diré circles are one of the most food insecure communities in Mali.

### *Participants*

Data used in this study were collected during the final evaluation of the GFSI project implemented by Africare in the Goundam and Diré circles in Mali. Participants in the study were selected from a sample of 22 villages that benefited from Africare's project activities. Anthropometric measurements (height-for-age, weight-for-age, and weight-height) of 860 under five age children from these villages were collected. 570 mothers of children (out of 860 children under age five) of 0-23 month age were interviewed on child feeding practices, information on knowledge, attitude and practices related to child health.

### *Data analysis*

This study, being a part of a series of child malnutrition studies initiated by the Regional Food for Peace Office (RFFPO), intends to analyze the relationship between child malnutrition status and the socio-economic status of households. Descriptive statistical analysis and cross-tabulation method were used to analyze this relationship. Chi-square test was performed for categorical variables to determine their association with child malnutrition status. For this purpose, most variables were transformed into nominal variables. The results of these analyses will be used to perform multivariate analysis.

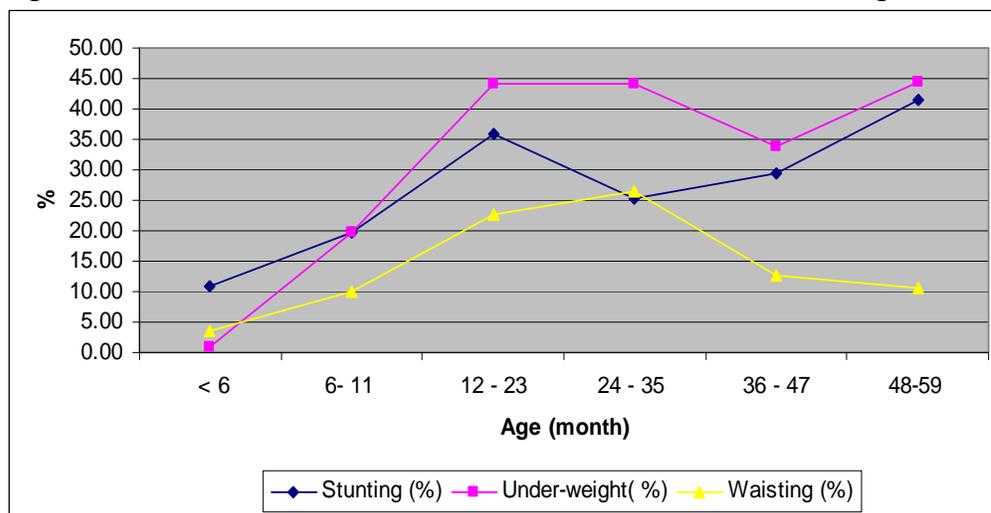
## **Results**

As data presented in Table 3 in 2006, the overall nutritional status of children under five in the Goundam/Dire area was poor. However, compared to the 2003 data, the situation has been improving because of the Africare/Mali GFSI project interventions. For example, 28% of the under five children in the project area were chronically malnourished in 2006 as compared to 34% in 2003. Similarly, the rate of underweight children under five decreased from 37% in 2003 to 34% in 2006. However, acute malnutrition or wasting among children under five increased sharply in July 2006 reaching 16% as compared to 2003 when the rate was 11%. This rate (16%) is above the World Health Organization emergency threshold rate. In 2007, the final evaluation team of the GFSI project noted "Overall, the nutrition activities have made great strides in a very short time towards achieving the project's objectives of enhancing the health and nutrition of mothers and children. The population underwent important changes of attitude and in practices toward family nutrition especially that of the child, care of pregnant mothers and sanitation. Another important achievement lies in the new community structures delivering essential health services, such as child growth monitoring, nutrition education and individual nutrition/health counseling, close to villages. The "Solidarity Cell" is another important local health and development

instrument brought into these villages by the project, providing security funds and food stocks for child nutrition rehabilitation or emergency health care for children and mothers.”

Usually in West Africa, malnutrition tends to be lower during the first year of life, when breastfeeding is more common, than in later years (CBASSE 1993). These findings were confirmed by the Goundam/Diré anthropometric data (Figure 1). In the study area, stunting rate in children younger than 6 months was 11% while it reached 41% for 48-59 month old children. A similar trend was found with underweight rate. For the wasting rate, the problem appears to be more serious in the 12 - 35 months age groups where rates are the highest after which it sharply drops in the 36-59 months age groups.

Figure 1: Evolution of Malnutrition Rate in Relation to Children’s Ages



Source: Africare Mali GFSI final evaluation survey

In addition, the study shows (Annex 1) that there are more stunted and underweighted boys than girls. However, with regards to wasting rate, there was no significant difference between boys and girls. The prevalence of child malnutrition varies according to location or among social, cultural, and economic groups. The villages from the Goundam circle are the first generation villages<sup>4</sup> of the project, and the Diré villages are the second generation with the program (five years with the program). The Goundam villages are more food insecure than the Diré villages. For short term malnutrition (underweight and wasting), the Goundam circle was more affected than Diré. For example, in 2006 the underweight rate was 37% in Goundam against 27% in Diré. The rate of wasted children was 18% in Goundam against 10% in Diré. Overall, first generation villages with agricultural potential had less malnourished children than new villages with no agricultural potential (Annex 1). Economic development potential and good child feeding practiced by mothers seem to be critical determinants of child malnutrition in the study areas.

<sup>4</sup> Defined as villages that have been benefiting from GFSI activities for 10 years.

The study collected data (2006) on three major factors (i.e., type of dwelling, access to potable water and use of latrines by the family) that appeared to influence the nutritional status in children under five. Analyses of the data show that short-term child malnutrition (i.e., underweight and wasting) is linked to poor dwelling environments (straw as compared mud-walled habitats), and lack of sanitation (i.e., no use of latrines). Where the population uses straw-wall houses (e.g. nomad population) with no latrines, underweight rate in children under five was 40% with 17%-23% of wasting rates (Annex 1). Both anthropometric parameters were lower in villages where children were raised in better constructed houses (e.g., mud or bricks-walled houses) and the families used latrines. The use of latrines confirms the numerous health benefits associated with hygiene. Improved living quarters were also equally beneficial, probably because of protecting the children from environmental hazards such as dust, heat, cold, etc. In contrast, the chronic malnutrition rate was less (23%) in children raised in straw habitat compared to mud-wall house children (29%).

Furthermore, analysis of data on the socio-economic status and mothers' characteristics and their effects on children's malnutrition status showed that mothers' age, their education levels, and their child feeding practices had direct impacts on the nutritional status of the children (Annex 1). The study showed that 23%, 26% and 13% of the children who were exclusively breastfed during the first six months of life were stunted, underweight and wasted, respectively. In contrast, when children were not exclusively breastfed during the first six months of life, 31%, 41% and 19% of them were stunted, underweight and wasted, respectively. These results confirm the importance of mothers' knowledge about child breastfeeding, particularly, during the first six months of life. Also, prenatal consultation of mothers with health care providers and delivery of their infants with the assistance of skilled birth attendants were positively correlated with children's nutritional performance. Such health care significantly reduced the rate of child malnutrition in the study areas.

Child malnutrition may arise from a number of conditions, such as lack of food, early cessation of breastfeeding, and diseases. These factors are generally interrelated, making it difficult to determine exactly how a child becomes malnourished. Relevant statistical methods such as the bivariate technique were used to evaluate the relationship between these factors and child malnutrition status. This bivariate technique allows to select variables (modalities) which are significantly ( $\chi^2$  test value  $> 2$  or Prob = 0.000) associated with the malnutrition of children under five in the study areas. The SPAD computer software was used to perform this analysis.

**Stunting:** the results of the bivariate analysis showed that the status of stunted children in the Goundam/Diré circles is associated with seven major variables: age of child, child's sex, weight/age ratio of child, mother's child feeding practice (particularly during the first six months of the child's life), episodes of diarrhea, access to drinking water and the educational level of the mother. There was a strong ( $\chi^2 = 36.7$  p= 0.000) relationship between child chronic malnutrition and underweight. For instance, the overall rate of underweight children was 34% in the study area. Regarding, the sub sample of stunted children, 69% of them was underweight. On the other hand, the relationship between

stunting and wasting was weak ( $p= 0.03$ ). Child's age seems to be an important determinant of chronic malnutrition in Goundam and Diré. The most affected age classes were 12-23 months ( $\chi^2 = 9.7$   $p= 0.000$ ), 36-47 months ( $\chi^2 = 7.7$   $p= 0.000$ ) and 48 – 59 months ( $\chi^2 = 6.3$   $p= 0.000$ ). In most nutritional studies conducted in Africa, children under 3 months of age are, on average, heavier than the standard children. From 6 to 23 months of age, malnutrition becomes more common as children experience repeated bouts of diarrhea and other childhood diseases (CBASSE 1993). Also, there is clear evidence that the major damage caused by child malnutrition takes place within the first two years of life. Once children have become stunted, they are likely to remain in that status into adulthood (Martorell et al. 1994\*). Mother's child feeding practice is associated with child chronic malnutrition ( $\chi^2=5.9$   $p=0$ ) in Goundam/Diré. Also, the level of association between stunting and child breastfeeding was strong ( $\chi^2 = 4.48$   $p=0.000$ ).

Numerous studies (Salah E.O Mahgoub et al., 2006; Kristen B Simondon, 2001) conducted in many parts of the world have demonstrated the beneficial effects (e.g., richness of diet, boosting the immune system, etc) of breast-feeding which is strongest in the first year. Mother's milk from breast-feeding provides important nutrients needed for growth. The milk also protects the child against diseases such as diarrhea and boosts the immune system so the risk of infection is reduced during weaning as the child starts to consume foods that may be contaminated with pathogens (Linda S. et al, October 1996). The protective effects of breastfeeding on children's nutritional status show that breastfeeding is an important part of child care. However, poor breastfeeding practices by mother such as prolonged breastfeeding or failure to introduce adequate complementary foods as recommended places children at risk for stunting or underweight (Madziringira N. 1995; Fawzi WW et al. 1998).

In this study, diarrhea was strongly ( $\chi^2 = 3.7$   $p= 0.000$ ) associated with child chronic malnutrition. Diarrhea during the first 6 months of life resulted in long term height deficit that is likely to be permanent. In contrast, diarrhea after the first 6 months of age showed temporary effects. Mother's educational level (illiteracy) was also significantly ( $\chi^2 = 4.01$   $p= 0.000$ ) linked to the chronic child malnutrition in Goundam/Dire areas. The study results showed that the prevalence of stunting in the Goundam/Dire area was also associated with the use of polluted water from traditional wells and rivers.

One important variable (low birth weight) associated with child malnutrition was missing in this survey. The relation between low child birth weight and stunting is well documented in child malnutrition literature. The effect of low child birth weight was found strongest in the first year of the childhood (Linda S. et al. October 1996).

Waterlow (1994) and Uauy (1994) concluded that despite numerous studies, relatively little is known about the causes and mechanisms of stunting.

**Underweight:** in addition to the variables associated with stunting as described above, child's low weight for age ratio was strongly linked to wasting ( $\chi^2 = 30.4$   $p= 0.000$ ), child's age (above 6-11 months), fever episodes ( $\chi^2 = 9.4$   $p= 0.000$ ), diarrhea ( $\chi^2 = 5.6$

p= 0.000), type of habitat used ( $\chi^2 = 6.0$  p= 0.000), the use of latrine ( $\chi^2 = 7.5$  p= 0.000) and the low educational level of mothers. Globally, 16% of the total population of children under five in the study was wasted. However, when the data were analyzed on the sub-sample of underweight children only, the rate of wasting in children under five jumped to 37%. Children above 11 months old were the most affected by the underweight problem. The prevalence of children suffering from episodes of fever and diarrhea 15 days before the survey was 10% and 30%, respectively. Among the underweight children, 16% and 36% of mothers declared that their child had experienced fever and diarrhea episodes during the last 15 days before the study. Furthermore, the result showed that underweight rate in children was associated with poverty. Twenty per cent of the underweight children were raised by mothers living in straw houses— typical living quarters for poor families—as compared to 16% for children of the general population living in such housing quarters. Moreover, in underweight children, 23% were living in the second generation villages of the project with low development potential<sup>5</sup>. In general, 18% of children under five were assessed in such an environment. Like stunting, underweight was associated with the age of the child. The prevalence of underweight becomes significantly higher between the ages of 12-23 months. This age class is very critical in the Sahel because it corresponds to the weaning period of children under five. Other studies in developing countries showed that diarrheal disease was increased when infants were not breast-fed, when water quality and excreta disposal were poor, and when weaning foods were prepared in an unhygienic manner (Cebu Study Team 1991 and 1992, VanDerslice et al. 1994+).

**Wasting or acute malnutrition:** the study results showed that this form of malnutrition is strongly associated with deprivation of food and poor environment (straw house, fever, diarrheal diseases). In the study area, wasting is strongly associated with underweight ( $\chi^2 = 30.4$  p= 0.000). In 2006, the average rate of underweight children was 34% in the Goundam/Dire area. However, among the wasted children, 75% was underweight. According to nutrition specialists, the low weight/age ratio of a child can result either from stunting or wasting. Women living in a poor environment (i.e., houses built with straw) had the highest prevalence of wasted children ( $\chi^2 = 8.4$  p= 0.000). The results showed that 25% of women with wasted children under five were living in a poor environment characterized by straw houses and inappropriate excreta disposal. Household food availability and access are also important determinants of the acute malnutrition of children under five in the Sahel region in general. In Goundam/Dire, the wasted children rate was strongly associated ( $\chi^2 = 6.7$  p= 0.000) with those households that reduced their food ration because of poverty, women who reduced the frequency of feeding their child because of poverty ( $\chi^2 = 8.8$  p= 0.000), and women who indicated the loss of weight of their children was associated with poor access to food ( $\chi^2 = 4.3$  p= 0.000). The GFSI survey results showed that 51% of women affirmed their household reduced food ration because of lack of food. But, for women with wasted children under five, this rate was 62%. Also, 29% of surveyed women reduced the frequency of their children feeding because of lack of food. In the sub-sample of women with wasted children mothers, this rate was 41%. As for stunting and underweight, wasting is associated with the age of the

---

<sup>5</sup> Lack of agricultural land

child. The most vulnerable age class is 12-23 months ( $\chi^2 = 8.3$  p= 0.000) and 24 – 35 months ( $\chi^2 = 11.2$  p= 0.000). Episodes of diarrhea and fever were common in the Goundam/Dire area and significantly associated with wasting. Even though, efforts have been made by the project to reduce the prevalence of these diseases they are still a public health concern. For instance, the prevalence of diarrhea among children under five was 47% in 2003; it was reduced to 31% in 2006 by the project. Its prevalence among wasted children under five was 37% during the same period. A high prevalence of blood diarrhea (15%) was found with wasted children against 8% in the children under five in general in the study area. In the project second generation villages with limited development resources<sup>6</sup>, the percent of wasted children living was 8% higher than the average rate (16%).

## **Conclusion**

The causes of child malnutrition in developing countries are well known and workable solutions do exist. However, in the Sahel, the complexity of this issue and the relationship between its underlying causes make it difficult and obscure and slow down the progress of efforts to combat this problem. In the study area, malnutrition rates in children under five were reduced as a result of FFP-funded Title II projects. Despite the positive achievements, there are still high levels of wasting (16%) and underweight (34%) in the study area. Economic development potential, good maternal child feeding practices and prenatal consultations seem to be critical determinants of child malnutrition in the Sahel region.

The results of this descriptive analysis confirm the observations and findings of other studies that show higher rates of stunting associated with age of the child, underweight, child's sex (boy), mother's child feeding practices (i.e., breastfeeding, complementary feeding, etc) and the educational level of mothers, episodes of diarrhea and fever, and access to drinking water. With regard to wasting, findings show that this form of malnutrition is strongly associated with food deprivation and poor living environment (i.e., straw dwellings, fever, and diarrhea diseases of child). Variables associated with underweight were either from stunting or wasting. These findings imply that reduction of child malnutrition in the Sahel is a long term development issue that the international community should understand and address. It cannot be solved by sporadic emergency interventions as it is a multidimensional issue that can be treated only with the allocation of adequate and reliable development resources.

---

<sup>6</sup> The project second phase villages with limited potential for the development of irrigation

Annex 1: Mali- Goundam/Dire Cercles – Child Malnutrition Descriptive Statistics

	Stunting (%)	Under-weight (%)	Waisting (%)
<b>Children age</b>			
< 6	11.0	0.8	3.5
06- 12	19.6	19.8	10.0
12 – 23	35.9	43.9	22.6
24 - 35	25.2	43.9	26.3
36 – 47	29.5	33.8	12.6
48-59	41.4	44.5	10.6
Total	28.2	34.3	16.1
<b>Children sex</b>			
Boy	32.1	35.6	16.0
Girl	23.6	32.8	16.3
<b>Cercle</b>			
Goundam	27.9	36.7	18.1
Dire	28.9	26.9	10.1
<b>Village categories</b>			
Old village with potential	20.0	25.7	14.3
Old village with limited potential	33.8	31.0	9.9
New village with potential	30.2	35.0	16.2
New village with limited potential	31.1	44.9	20.9
<b>Type of habitat</b>			
Mud	29.0	33.2	15.0
Straw	22.3	39.9	23.2
<b>Potable water source</b>			
Traditional well	33.2	35.3	15.1
Rivers	31.8	37.7	14.1
Modern well	28.8	35.9	17.9
Borehole	26.8	33.7	15.5
<b>Hygenic environment</b>			
Latrine	29.8	27.8	14
Nature	26.7	40.7	17.9

Source: Africare Mali GFSI Final evaluation Survey –December 2006

Annex 2: Mali- Goundam/Dire Cercles – Child Malnutrition Descriptive Statistics

	Stunting (%)	Under-weight( %)	Waisting (%)
<b>Socio-economic characteristics of Child mother</b>			
<b>Education level</b>			
Primary school	27.9	19.7	10.8
Medersa	7.7	24	8
Secondary school	9.3	16.1	16.1
Analphabetes	27.7	28.2	13.7
adult literacy	21.0	49.3	5.6
Coranic school	28.1	35.3	17.8
<b>Age (year)</b>			
< 20	13.1	6.5	3.3
20 - 24	23.5	29.3	12.4
25- 29	28.5	34.5	18.1
30-34	26.6	39.8	16.7
35-39	28.3	32.5	23.1
40 and +	34.5	38.3	15.1
<b>Assisted by a village birth attendant</b>			
No	27.0	34.4	17.4
Yes	24.1	26.7	11.6
<b>Prenatal Consultation</b>			
No	26.0	35.3	19.3
Yes	24.8	28.4	12.2
<b>Breastfeeding</b>			
No	30.8	41.4	18.7
Yes	23.3	26.3	13.6
<b>Breastfeeding after delivery</b>			
Immediately	19.2	25.3	13.8
8 hours after	28.5	27.7	10.1
24 hours after	21.9	26.0	18.9
48 hours after	38.5	31.3	6.99
<b>Nothing before breastfeeding</b>			
No	27.1	36.6	18.7
Yes	24.8	25.0	10.5
<b>Reduction the number of child feeding because of poverty</b>			
No	28.9	32.5	13.2
Yes	21.5	33.5	22.1

Source: Africare Mali GFSI Final evaluation Survey –December 2006

## References

Africare Mali, Goundam Food Security Initiative (GFSI) - Household Survey Results – August 2001.

Antonio L. Cunha, Peter A. Margolis, Steven Wing – Community Economic Development and acute lower respiratory infection in Children.

Carlos Larrea, Pedro Montalvo, Ana Maria Ricaurte - Child Malnutrition, Social Development and Health Services in the Andean Region

Demographic & Health Survey III – Mali 2001

Jean Pierre LECH AUD, Université Montesquieu Bordeaux IV- France, La dynamique de l'inégalité de la malnutrition des enfants en Afrique. Une Analyse comparative fondée sur une décomposition de régression.

Lisa C Smith, Lawrence Haddad, IFPRI, Explaining Child Malnutrition in Developing Countries – A Cross-Country Analysis.

G. Phillippeau, STAT-ITCF, comment interpréter les résultats d'une analyse en composantes principales ?

Nepali Sah, Save the Children Japan-Nepal Office - Determinants of Child Malnutrition in Nepal: A Case Analysis from Dhanusha, Central Terai of Nepal.

Programme Alimentaire Mondial (PAM), Système d'alerte Précoce (SAP) Mali – Suivi de la sécurité Alimentaire à Travers les sites sentinelles Résultats du premier passage des enquêtes – Juin 2005

Programme Alimentaire Mondial (PAM), Système d'alerte Précoce (SAP) Mali - Enquêtes médico-nutritionnelles et socio-économiques dans les zones nomades de Ber( Tombouctou), N' Tillit, Bamba et Temera (GAO), Adjelhok et Anafif (KIDAL) et Dans le Sahel Occidental – Juillet 2005

Systeme SPAD pour Window, Version 5, SPAD Base – Aide à l'interprétation.

V. Kelly, J. Teff, J.Oehmke, and John Staatz, Staff Paper – Identifying Policy Relevant Variables for Reducing Childhood Malnutrition

AFRICARE Goundam Food Security Initiative: Mid term Evaluation, 2006

AFRICARE Goundam Food Security Initiative: Final Evaluation, January 2007

The World Bank « Repositioning Nutrition as Central to Development A Strategy for Large-Scale Action » 2006

Linda S. Adair and David K. Guilkey, Age-Specific Determinants of Stunting in Filipino Children, *The Journal of Nutrition* Vol. 127 No. 2 February 1997, pp. 314-320

Salah E.O. Mahgoub, Maria Nnyepi, Theodore Bandeke, Factors Affecting Prevalence of Malnutrition Among Children Under Three Years of Age in Botswana, *AJFAND* Volume 6 No 1, 2006

William Checkley, Leonardo D. Epstein, Robert H. Gilman, Lilia Cabrera and Robert E. Black, Effect of Acute Diarrhea on Linear Growth in Peruvian Children, *Am J Epidemiology* 2003; 157:166-175

Commission on Behavioral and Social Sciences and Education (CBASSE), Effect of Health Programs on Child Mortality in Sub-Saharan Africa (1993).

West Africa 2006 Revision - Consolidated Appeal Process (CAP) - OCHA

Madzingira N Malnutrition in children under five in Zimbabwe: effect of socio-economic factor and disease *Soc. Biol.* 1995; 42(3-4); 239-46.

Barret H and Browne Health Hygiene, maternal education: Evidence from Gambia, *Soc. Sci Med* 1996; 43; 1579-1590

Rowland MG, Rowland SG and TJ Cole The impact of nutrition on the growth of children from 0-2 years in age in urban West Africa community. *Am. J. Clin Nutr.* 1988; 47:134-48.

Dettwyler KA Breast feeding and weaning in Mali: cultural context and Madzingira N. 1995; Fawzi WW et al. 1998