



# Mali 2001

## Nutrition of Young Children and Mothers



Cellule de Planification et de Statistique  
Ministère de la Santé  
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U.S. Agency for International Development



ORC Macro

AFRICA NUTRITION CHARTBOOKS

**NUTRITION OF YOUNG CHILDREN AND MOTHERS  
IN MALI**

Findings from the 2001 Mali Demographic and Health Survey

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# Introduction

Malnutrition<sup>1</sup> is one of the most important health and welfare problems among infants and young children in Mali. It is a result of both inadequate food intake and illness. Inadequate food intake is a consequence of insufficient food available at the household level, improper feeding practices, or both. Improper feeding practices include both the quality and the quantity of foods offered to young children, as well as the timing of their introduction. Poor sanitation puts young children at increased risk of illness, in particular diarrheal disease, which adversely affects their nutritional status. Both inadequate food intake and poor environmental sanitation reflect underlying social and economic conditions.

Malnutrition has significant health and economic consequences, the most serious of which is an increased risk of death. Other outcomes include an increased risk of illness and a lower level of cognitive development, which results in lower educational attainment. In adulthood, the accumulated effects of long-term malnutrition can be a reduction in workers' productivity and increased absenteeism in the workplace; these may reduce a person's lifetime earning potential and ability to contribute to the national economy. Furthermore, malnutrition can result in adverse pregnancy outcomes.

The data presented here are from the 2001 Mali Demographic and Health Survey (MDHS 2001), a nationally representative survey of 12,331 households, conducted by the Mali National Institute of Statistics and Economic Analysis and financed by the U.S. Agency for International Development (USAID), UNICEF, the World Bank, and the Government of Mali. ORC Macro provided technical assistance through its MEASURE *DHS+* program.

Of the 13,208 children age 0-59 months who were part of the study, 9,408 who were alive, whose mothers were interviewed, and who had complete anthropometric data were included in the nutrition analyses. Unless otherwise noted, all analyses include only children whose mothers were interviewed. Nutritional data collected on these children include height, weight, age, breastfeeding history, and feeding patterns. Information was also collected on the prevalence of diarrhea and acute respiratory infection (ARI) in the two weeks prior to the survey and on relevant sociodemographic characteristics. For comparison, data are presented from Demographic and Health Surveys conducted in other sub-Saharan countries.

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<sup>1</sup> The technical method of identifying a *malnourished* population as defined by the U.S. National Center for Health Statistics (NCHS), the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO) is presented in Appendix 2.

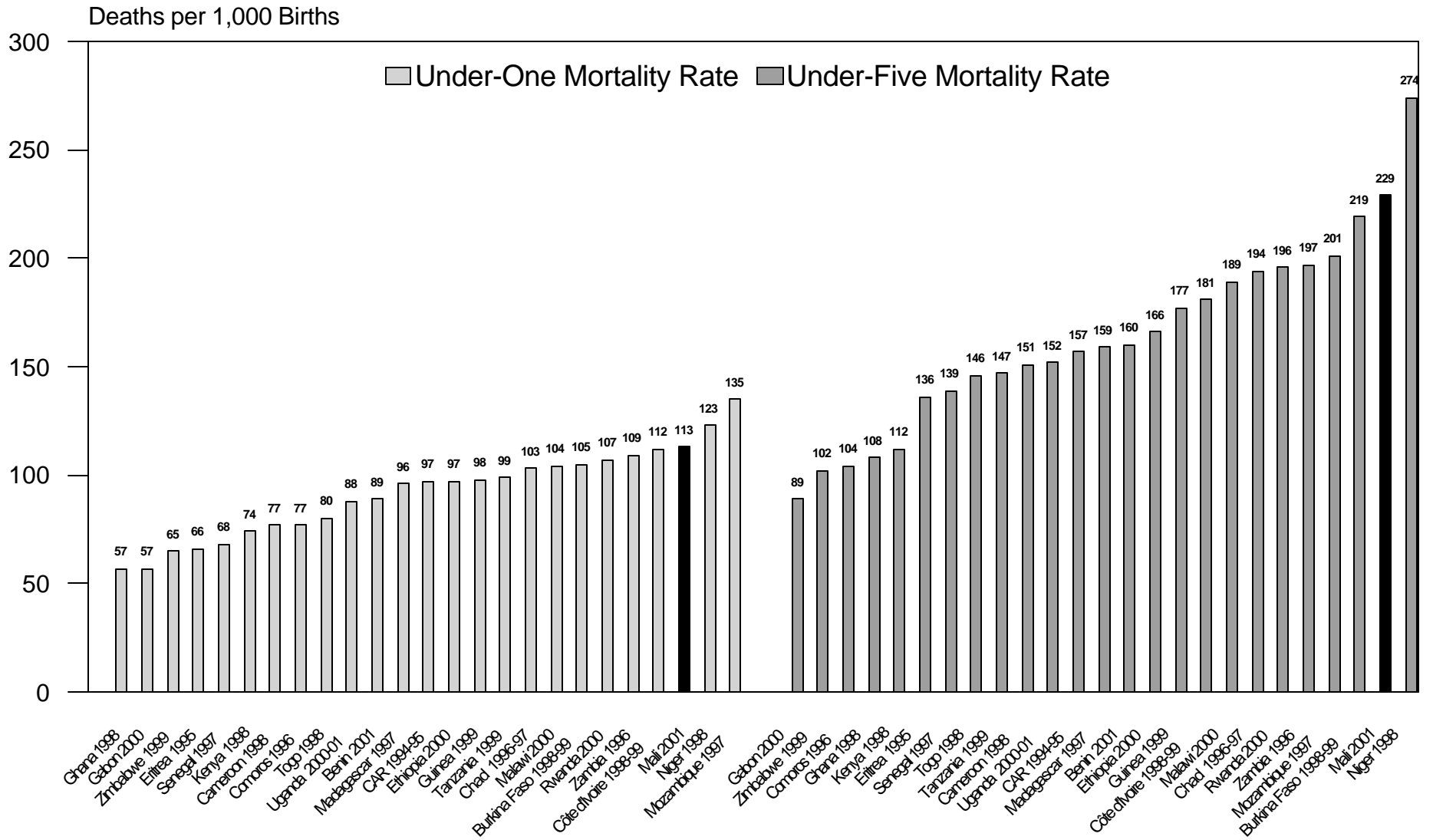
## **Figure 1: Infant and Child Mortality, Mali Compared with Other Sub-Saharan Countries**

Malnutrition compromises child health, making children susceptible to illness and death. Infectious diseases such as acute respiratory infections, diarrhea, and malaria account for the greatest proportion of infant and under-five mortality. The infant mortality rate (under-one rate) is a commonly used measure of infant health and is a sensitive indicator of the socioeconomic conditions of a country. The under-five mortality rate is another informative indicator of infant and child survival.

- **Mali's under-one mortality rate (113 deaths per 1,000 births) indicates that over 11 percent of children born in Mali will die before their first birthday.** This rate is at the high end of the sub-Saharan countries surveyed.
- **Mali's under-five mortality rate (229 deaths per 1,000 births) indicates that about 23 percent of children born in Mali will die before their fifth birthday.** This rate also places Mali at the high end of the sub-Saharan countries surveyed.

# Figure 1

## Infant and Child Mortality, Mali Compared with Other Sub-Saharan Countries



## Figure 2: Contribution of Undernutrition to Under-Five Mortality, Mali

Undernutrition is an important factor in the death of many young children. Even if a child is only mildly malnourished, the mortality risk is increased. In developing countries, under-five mortality is largely a result of infectious diseases and neonatal deaths. Respiratory infections, diarrhea, malaria, measles, and other infectious diseases take their toll on children.

Formulas developed by Pelletier et al.<sup>1</sup> are used to quantify the contributions of moderate and severe malnutrition to under-five mortality.

In Mali,

- **Fifty percent of all deaths that occur before age five are related to malnutrition (severe and moderate malnutrition).**
- **Because of its extensive prevalence, moderate malnutrition (37 percent) contributes to more deaths than severe malnutrition (13 percent).**
- **Moderate malnutrition is implicated in 74 percent of deaths associated with malnutrition.**

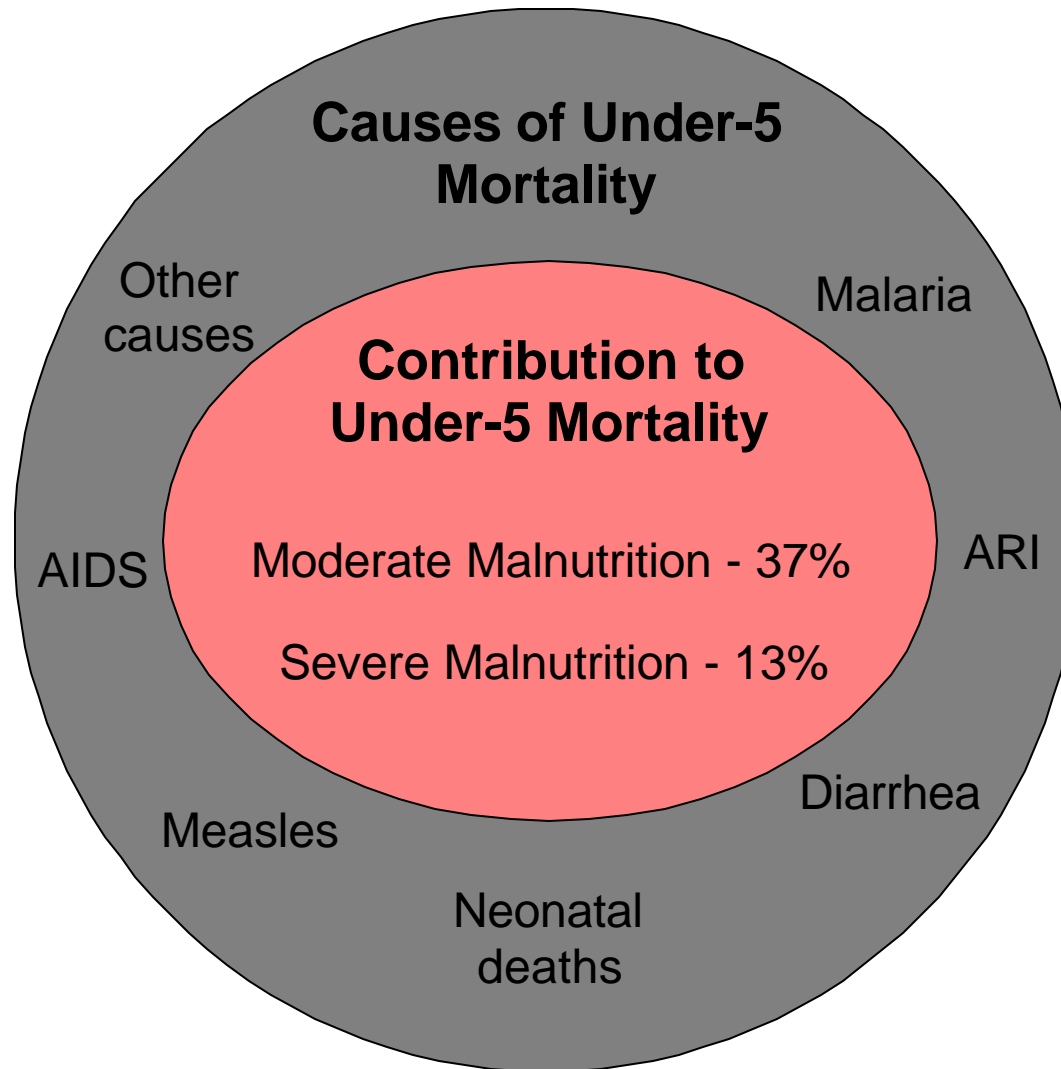
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<sup>1</sup> Pelletier, D. L., E. A. Frongillo, Jr., D. G. Schroeder, and J. P. Habicht. 1994. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *Journal of Nutrition* 124 (10 Suppl.): 2106S-2122S.



# Figure 2

## Contribution of Undernutrition to Under-Five Mortality, Mali



Note: Calculation based on Pelletier et al., 1994.

## Figure 3: Survival and Nutritional Status of Children, Mali

Malnutrition and mortality both take a tremendous toll on young children. This figure illustrates the proportion of children who have died or are undernourished at each month of age.

In Mali,

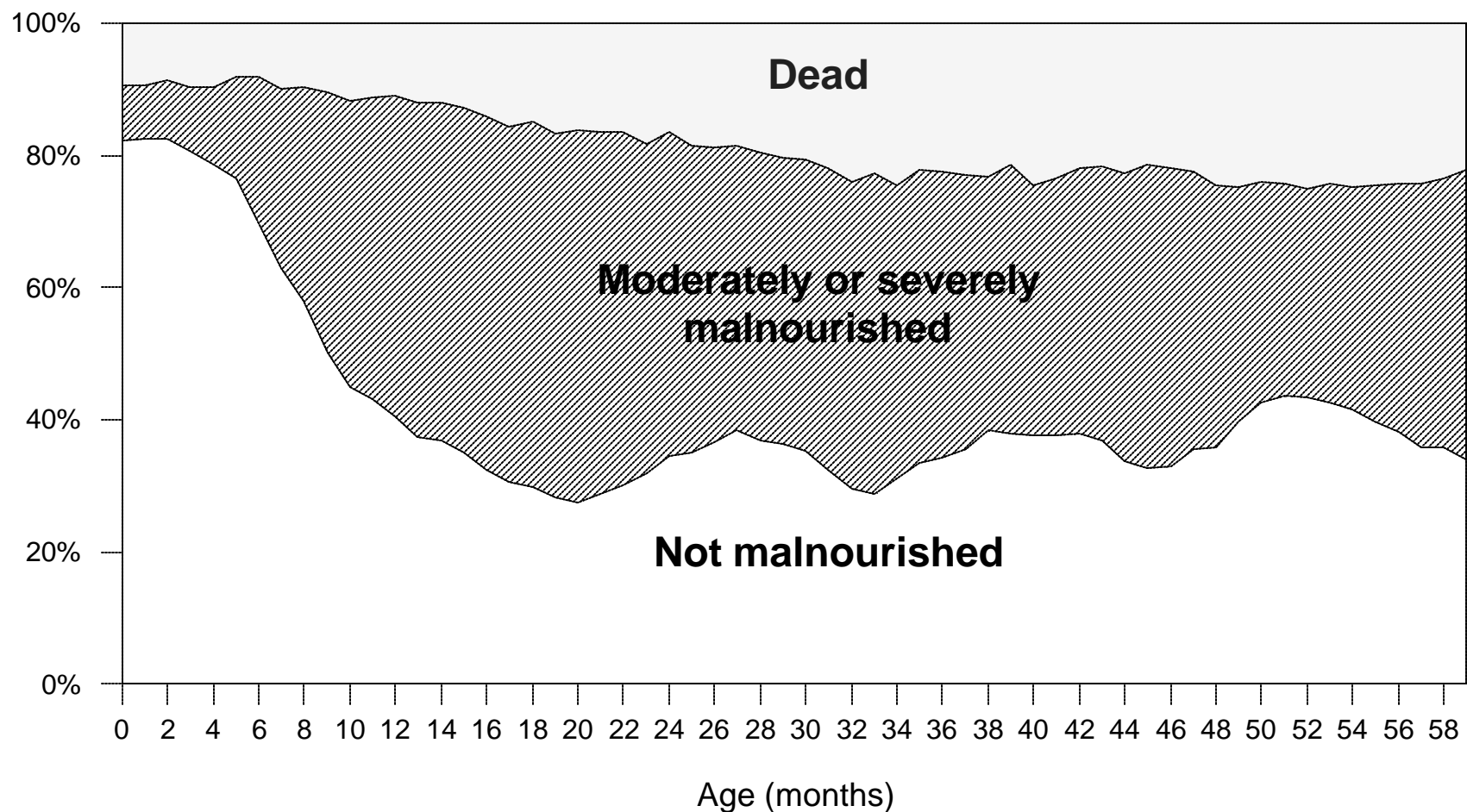
- **Between birth and 20 months of age, the percentage of children who are alive and not malnourished drops rapidly from about 82 percent to 28 percent.** Thereafter, the rate cycles between 30 and 39 percent until 46 months, increases to 44 percent at 51 months, and then declines to 34 percent through 59 months.
- **Between birth and 20 months of age, the percentage of children who are moderately or severely malnourished<sup>1</sup> increases dramatically from 8 percent to 56 percent.** This percentage then declines to 38 percent at 40 months, declines to 31 percent at 52 months, then increases to 43 percent at 59 months.
- **From birth until 59 months, the percentage of children who have died increases gradually, ranging from 10 percent at birth to 16 percent at 20 months, 25 percent at 40 months and then declining slightly to 22 percent through 59 months.**

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<sup>1</sup> A child with a Z-score below minus three standard deviations ( $-3$  SD) on the reference standard is considered severely malnourished, while one with a Z-score between  $-2$  SD and  $-3$  SD is considered moderately malnourished.

# Figure 3

## Survival and Nutritional Status of Children, Mali



Note: A child with a Z-score below -3 SD on the reference standard is considered severely malnourished (stunted, wasted, or underweight), while a child with a Z-score between -3 SD and -2 SD is considered moderately malnourished. Values have been smoothed using a five-month rolling average.

# Malnutrition in Mali

## Figure 4: Malnutrition among Children under Five Years, Mali

In Mali,

- **Thirty-eight percent of children age 0-59 months are chronically malnourished.** In other words, they are too short for their age, or *stunted*.<sup>1</sup> The proportion of children who are stunted is 19 times the level expected in a healthy, well-nourished population.
- **Acute malnutrition**, manifested by *wasting*,<sup>2</sup> results in a child being too thin for his or her height. **It affects 11 percent of children**, which is 5.5 times the level expected in a healthy population.
- **Thirty-three percent of children under five years are *underweight***<sup>3</sup> for their age. This is more than 11 times the level expected in a healthy, well-nourished population.
- **Only 7 percent of children under five are *overweight***.<sup>4</sup> This is half of the level expected in a healthy, well-nourished population.

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<sup>1</sup> A stunted child has a height-for-age Z-score that is below -2 SD based on the NCHS/CDC/WHO reference population. Chronic malnutrition is the result of an inadequate intake of food over a long period and may be exacerbated by chronic illness.

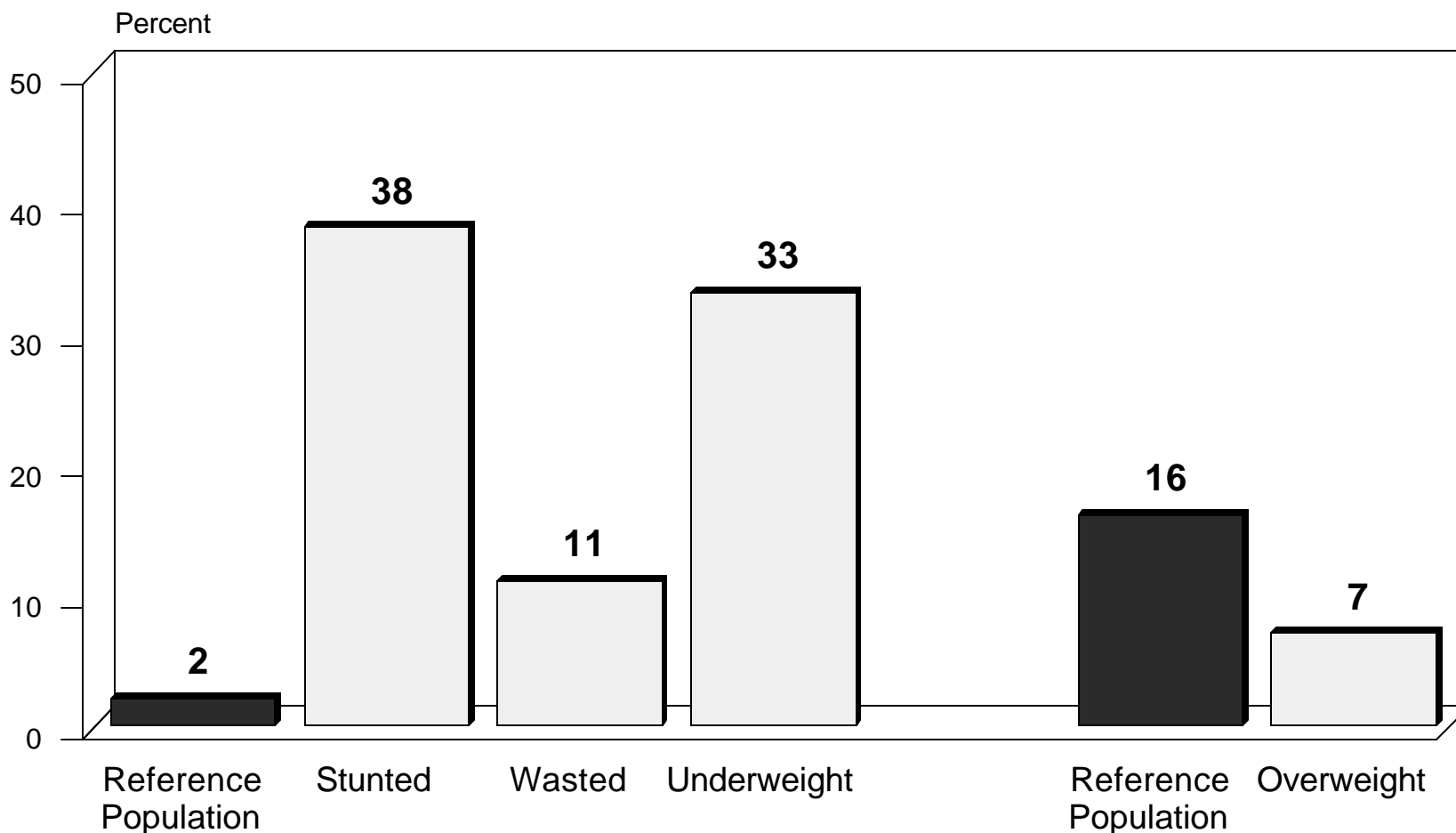
<sup>2</sup> A wasted child has a weight-for-height Z-score that is below -2 SD based on the NCHS/CDC/WHO reference population. Acute malnutrition is the result of a recent failure to receive adequate nutrition and may be affected by acute illness, especially diarrhea.

<sup>3</sup> An underweight child has a weight-for-age Z-score that is below -2 SD based on the NCHS/CDC/WHO reference population. This condition can result from either chronic or acute malnutrition or a combination of both.

<sup>4</sup> An overweight child has a weight-for-height Z-score that is above 1 SD based on the NCHS/CDC/WHO reference population.

# Figure 4

## Malnutrition among Children under Five Years, Mali



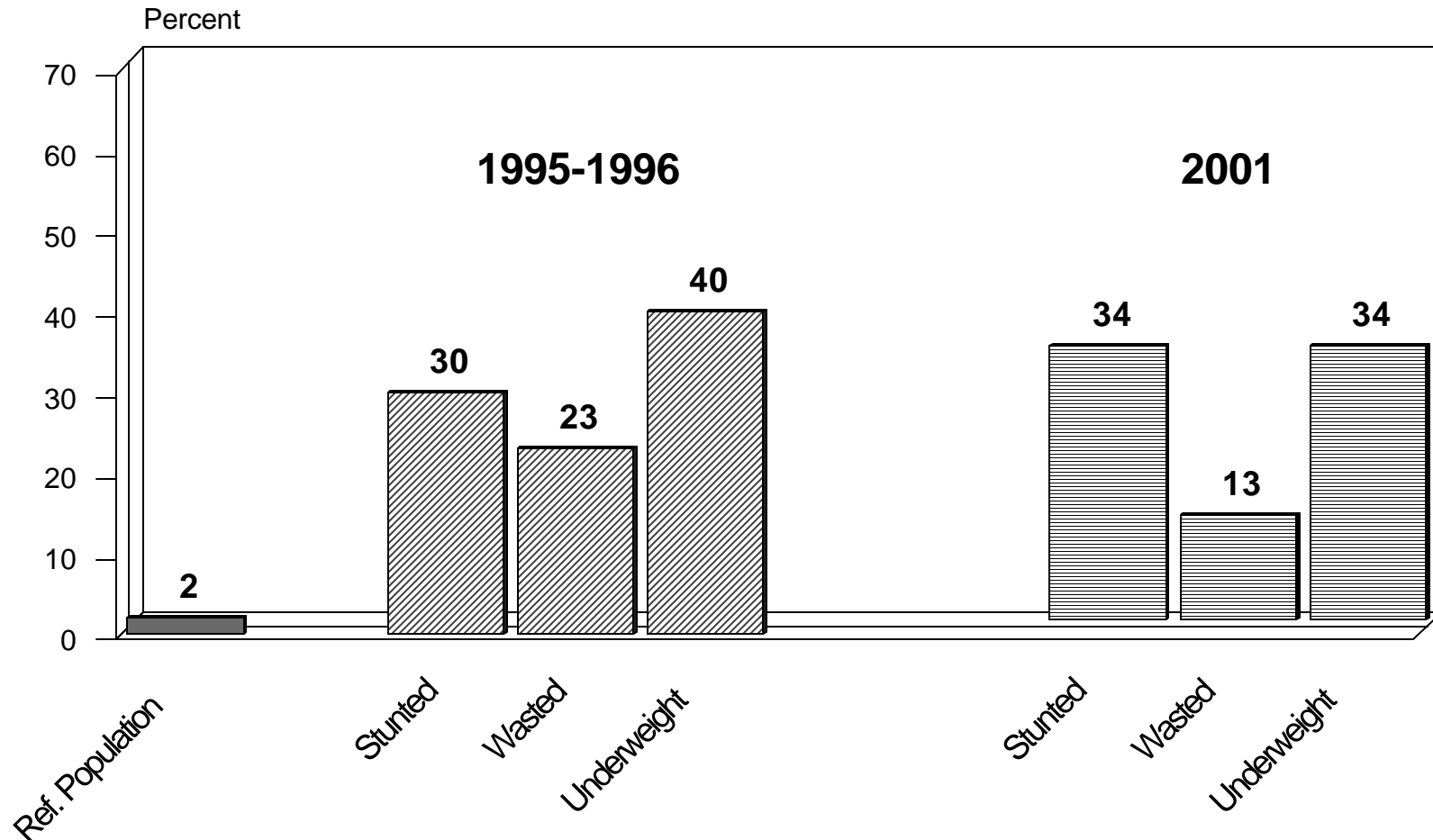
Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both.

## **Figure 5: Changes in Undernutrition Rates among Children under Three Years, Mali 1995-96 and 2001**

- **The findings of the 2001 MDHS suggest that acute malnutrition rates in Mali have declined since the 1995-96 survey, while chronic malnutrition rates have increased.**
- In 1995-96, stunting affected 30 percent of children under three, compared with 34 percent in 2001. Twenty-three percent of children were wasted in 1995-96, compared with 13 percent in 2001. In 1995-96, 40 percent of children were underweight, while in 2001, 34 percent were underweight.

# Figure 5

## Changes in Undernutrition Rates among Children under Three Years, Mali 1995-96 and 2001



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both.



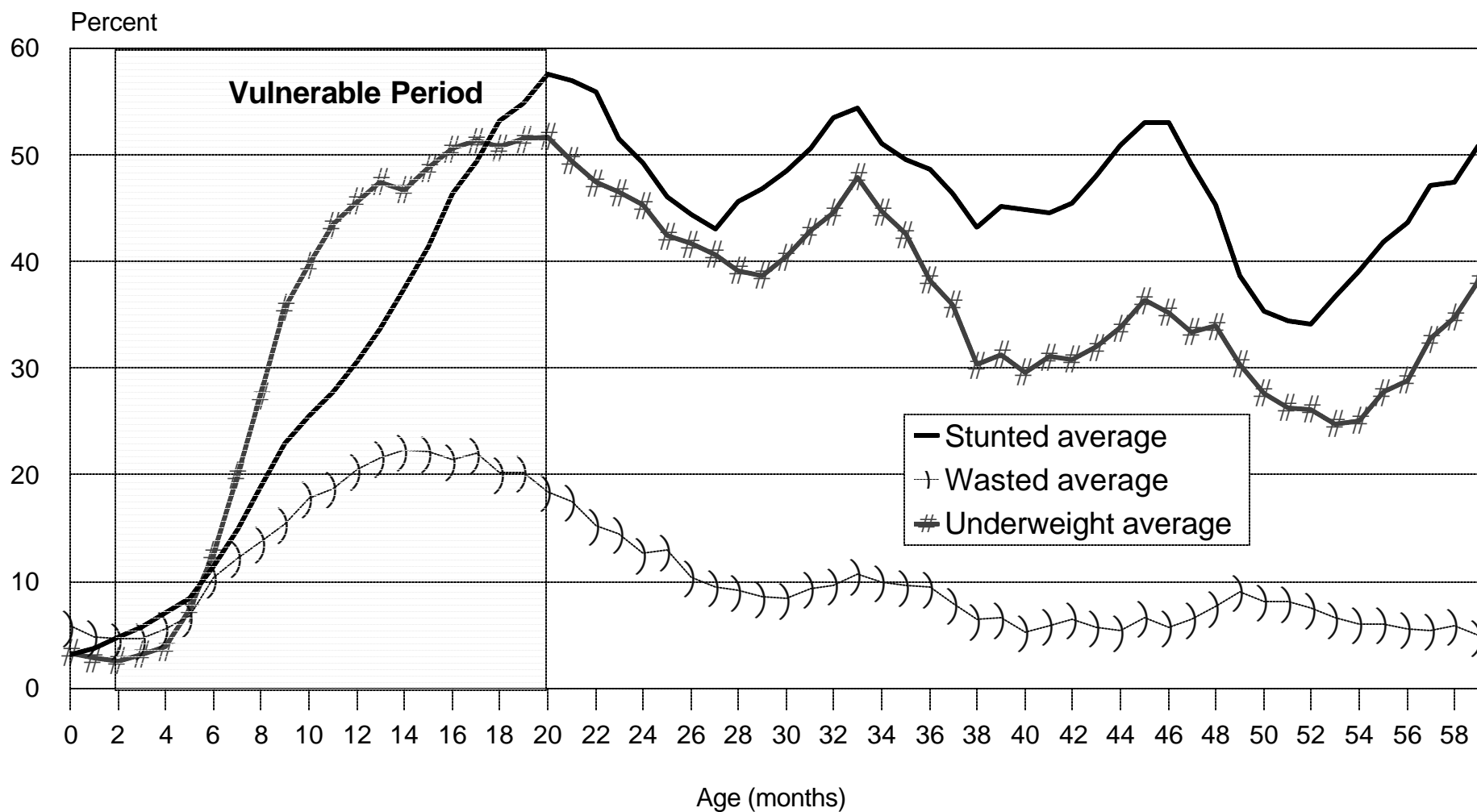
## Figure 6: Stunting, Wasting, and Underweight by Age, Mali

In Mali, the time between 2 months and 20 months of age is a vulnerable period.

- **The proportion of children stunted rises sharply between 2 and 20 months of age, peaking at 53 percent.** The proportion of children stunted then undulates, ranging from 43 to 54 percent until it drops to 34 percent at 51 months, increasing again to 51 percent at 59 months.
- **The proportion of children wasted rises to 22 percent at 13 months and then declines slowly to 8 percent at 30 months.** The proportion then continues to decline, reaching 5 percent at 58 months.
- **The proportion of children underweight rises sharply between 4 and 20 months of age, when it reaches 52 percent.** The proportion then cycles to a low of 25 percent by 53 months and rises again to 38 percent at 59 months.

# Figure 6

## Stunting, Wasting, and Underweight by Age, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both. Plotted values are smoothed by a five-month moving average.

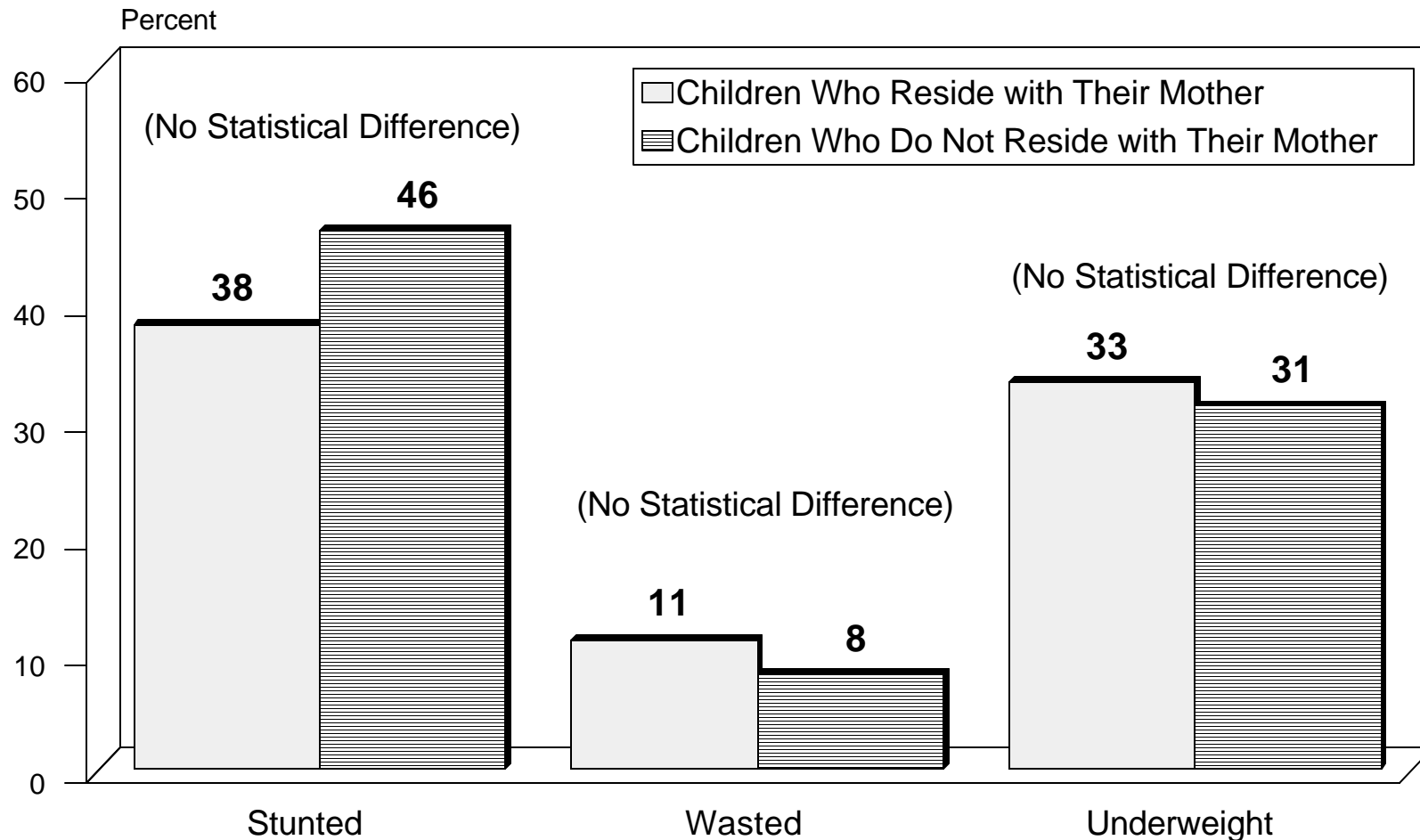
## **Figure 7: Undernutrition among Children under Five Years Who Do Not Reside with Their Mother, Mali**

Previously, anthropometric data from DHS surveys excluded children whose mother did not live in the household or was not present to be interviewed. Currently, all children in the household are measured, regardless of their mother's residence status. In the MDHS 2001, 408 children under five years did not reside with their mother.

- **In Mali, there was no statistical relationship between malnutrition rates and children's residence with their mother.**

# Figure 7

## Undernutrition among Children under Five Years Who Do Not Reside with Their Mother, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both.

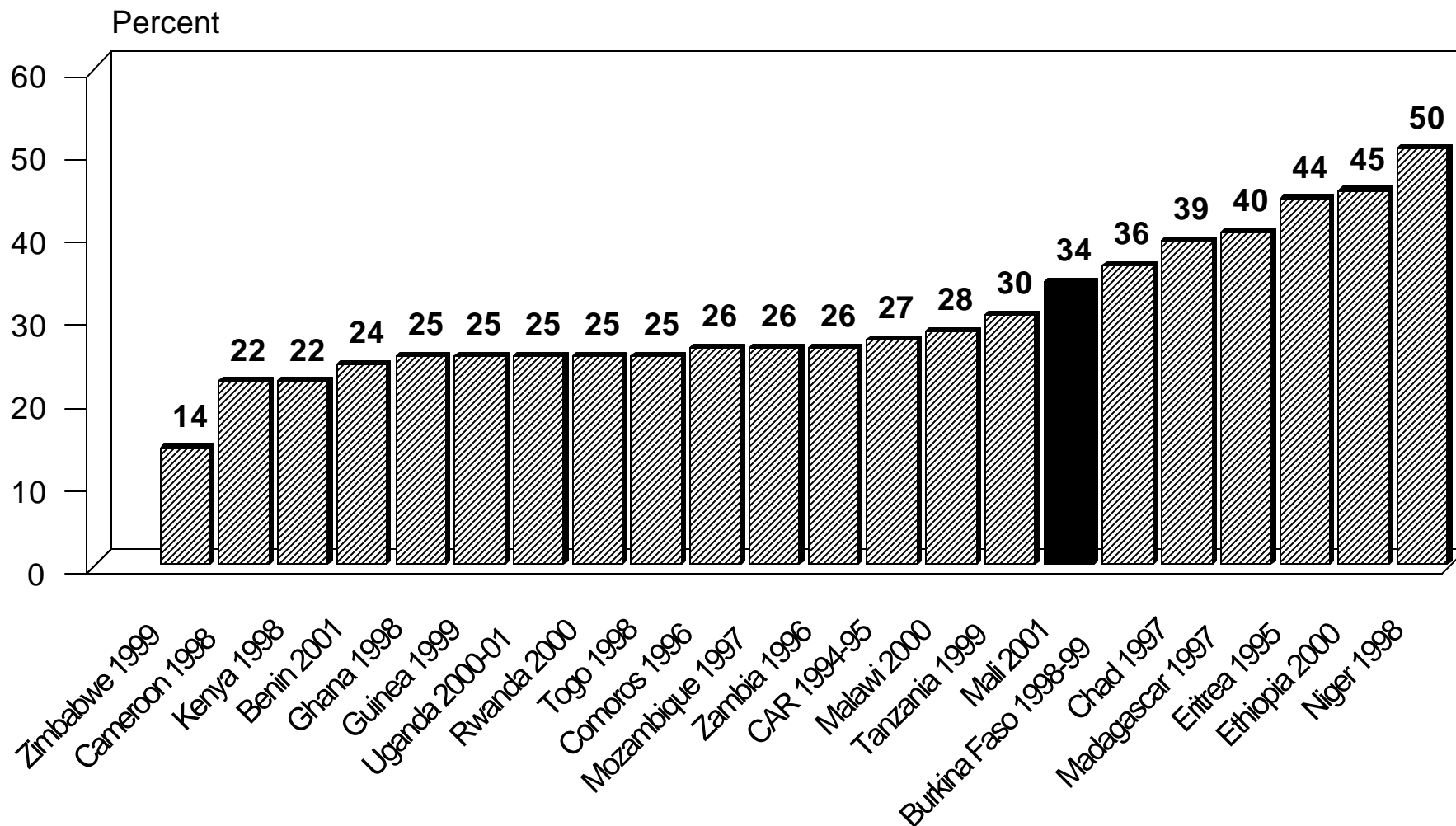
## Figure 8: Underweight among Children under Three Years, Mali Compared with Other Sub-Saharan Countries

Among the sub-Saharan countries surveyed,

- The percentage of children **under three years** who are *underweight* ranges from 14 to 50 percent. **With 34 percent of children under three years being underweight, Mali is in the upper third of the sub-Saharan countries surveyed.** Underweight status is indicative of children who suffer from chronic or acute malnutrition, or both, and may be influenced by both short- and long-term determinants of malnutrition. Underweight is often used as a general indicator of a population's health status.

# Figure 8

## Underweight among Children under Three Years, Mali Compared with Other Sub-Saharan Countries



Note: *Underweight* reflects chronic or acute malnutrition or a combination of both.

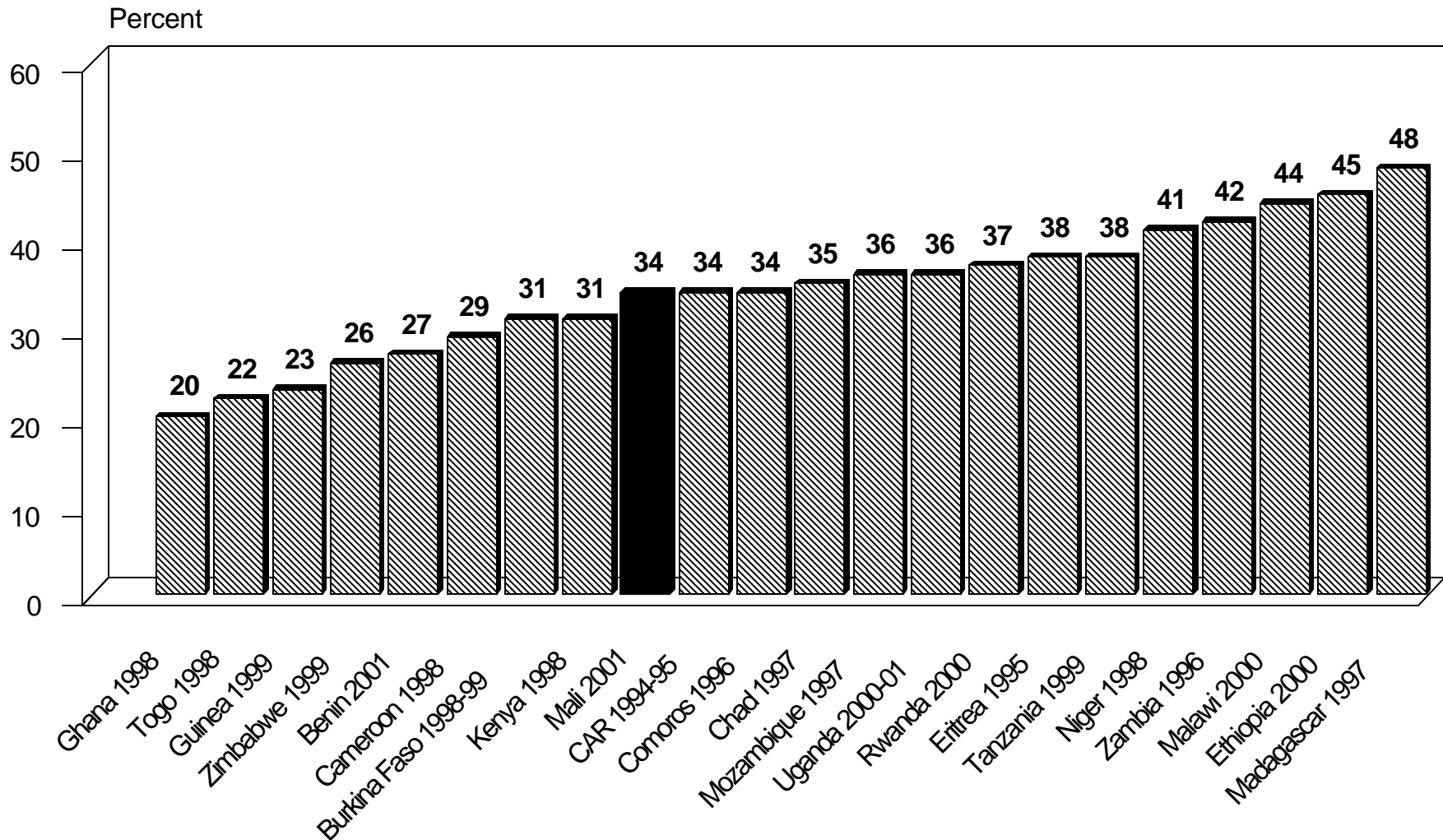
## **Figure 9: Stunting among Children under Three Years, Mali Compared with Other Sub-Saharan Countries**

Among the sub-Saharan countries surveyed,

- The percentage of children **under three years** who are *stunted* ranges from 20 to 48 percent. **At 34 percent, the proportion of children under three years who are stunted in Mali is in the midrange of the sub-Saharan countries surveyed.** Stunting is a good long-term indicator of the nutritional status of a population because it is not markedly affected by short-term factors such as season of data collection, epidemic illnesses, acute food shortages, and recent shifts in social or economic policies.

# Figure 9

## Stunting among Children under Three Years, Mali Compared with Other Sub-Saharan Countries



Note: *Stunting* reflects chronic malnutrition.



# Conceptual Framework for Nutritional Status

Nutrition is directly related to food intake and infectious diseases such as diarrhea, acute respiratory infections, malaria, and measles. Both food intake and infectious diseases reflect underlying social and economic conditions at the household, community, and national levels that are supported by political, economic, and ideological structures within a country.

The following diagram is a conceptual framework for nutrition adapted from UNICEF.<sup>1</sup> It illustrates relationships among factors and their influences on children's nutritional status. Although political, socioeconomic, environmental, and cultural factors (at the national and community levels) and poverty (at the household level) affect the nutritional status of women and children, the only variables included in this chartbook are those that can be collected as part of a national household survey. The highlighted areas of the framework depict selected factors.

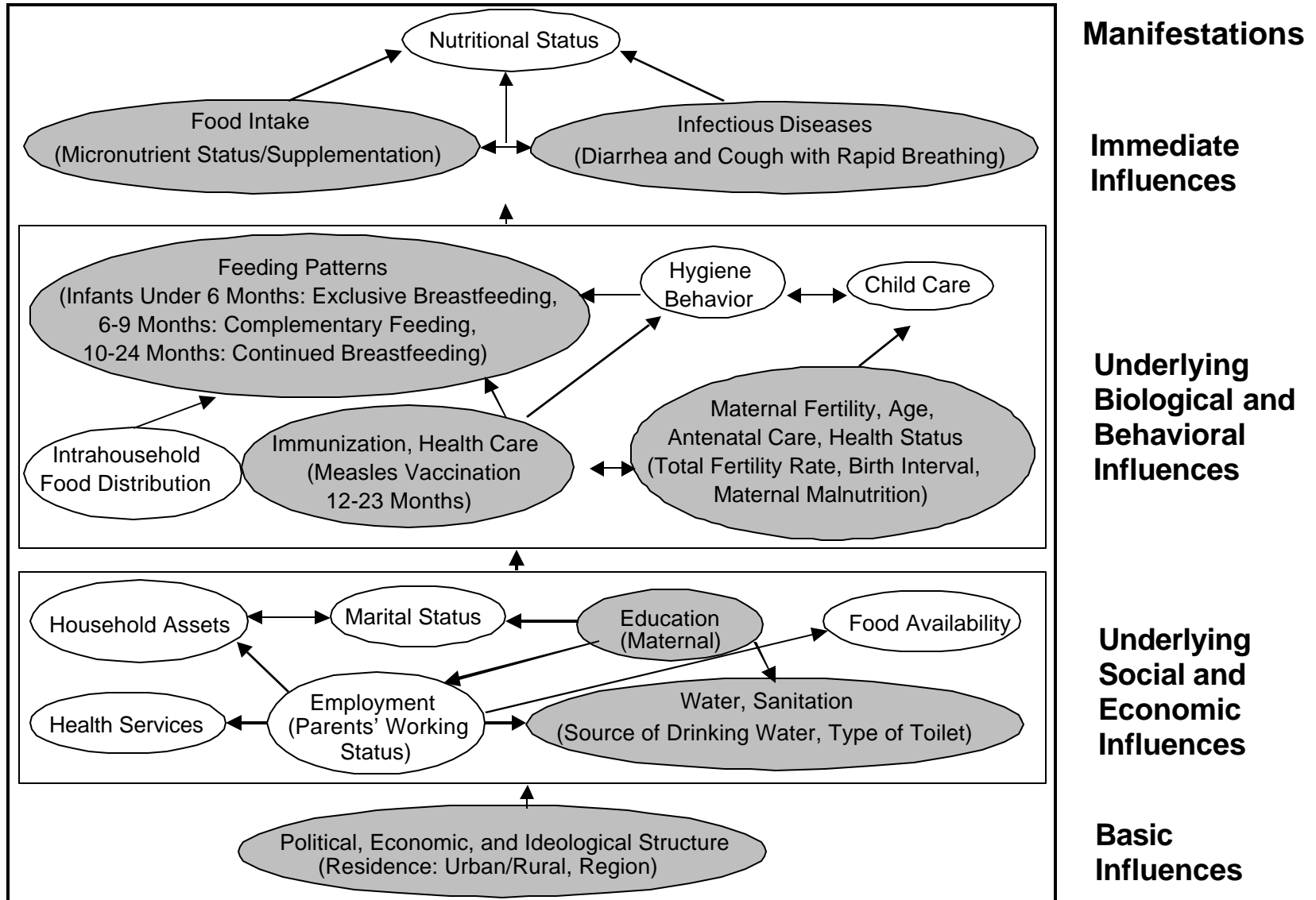
The factors are

- **Immediate influences**, such as food intake (micronutrient status and supplementation) and infectious disease (diarrhea and respiratory infections)
- **Underlying biological and behavioral influences**, such as maternal fertility, measles vaccinations, and feeding patterns of children under two years
- **Underlying social and economic influences**, such as maternal education, drinking water, and sanitation
- **Basic influences**, such as area of residence.

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<sup>1</sup> State of the World's Children, 1998

# Conceptual Framework for Nutritional Status



# Immediate Influences of Malnutrition

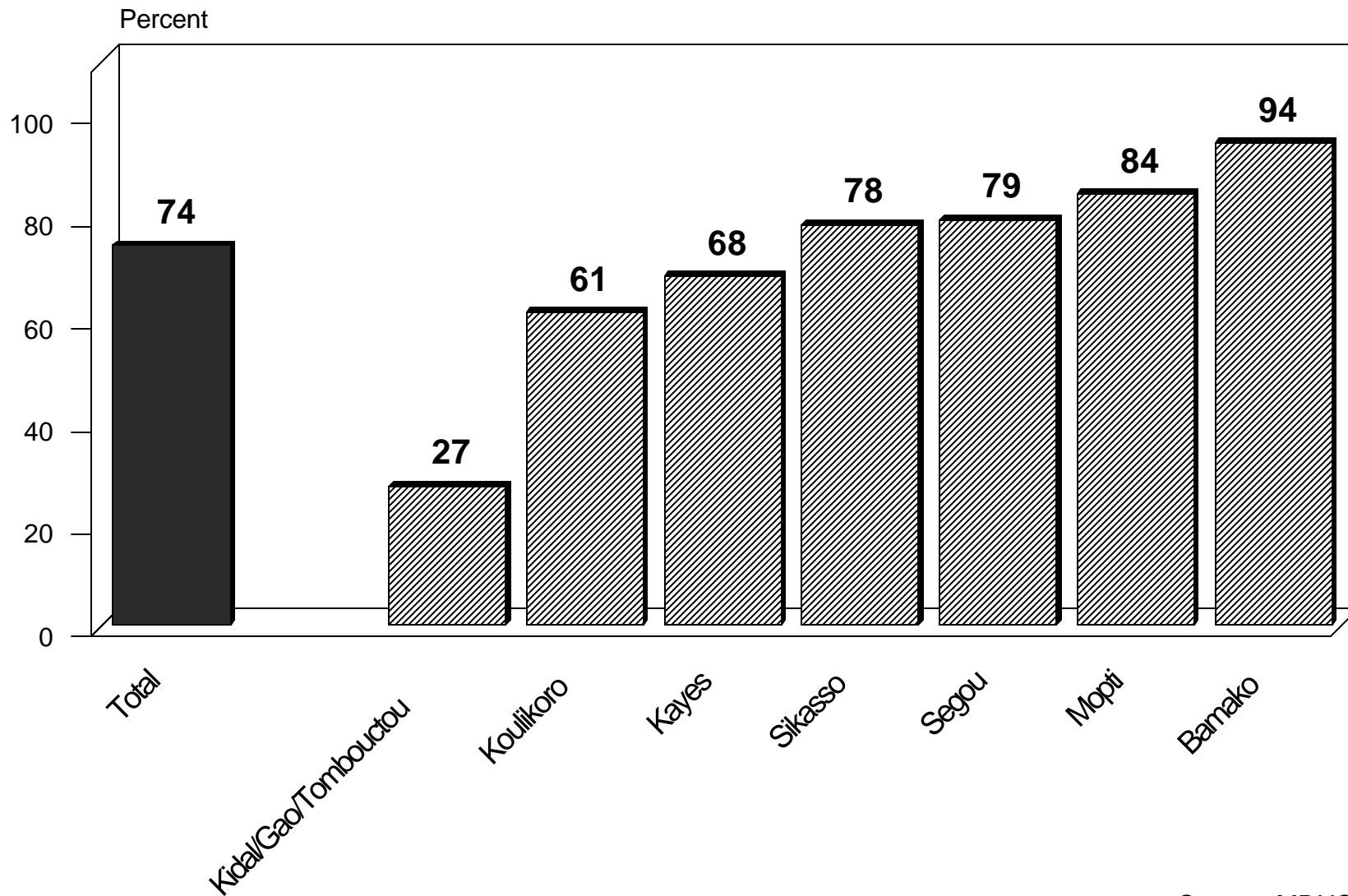
## Figure 10: Children under Five Years Living in Households with Iodized Salt by Region, Mali

Iodine deficiency is known to cause goiter, cretinism (a severe form of neurological defect), spontaneous abortion, premature birth, infertility, stillbirth, and increased child mortality. One of the most serious consequences for child development is mental retardation caused by iodine deficiency disorder (IDD), which puts at risk social investments in health and education. IDD is the single most common cause of preventable mental retardation and brain damage in the world. It decreases the production of hormones vital to growth and development. Children with IDD can grow up stunted; apathetic; mentally retarded; and incapable of normal movement, speech, or hearing. IDD in pregnant women may cause miscarriage, stillbirth, and mental retardation in infants.

The remedy for IDD is relatively simple. A teaspoon of iodine is all a person requires in a lifetime, but since iodine cannot be stored for long periods by the body, tiny amounts are needed regularly. In areas of endemic iodine deficiency, where soil and therefore crops and grazing animals do not provide sufficient dietary iodine to the population, food fortification and supplementation have proven to be highly successful and sustainable interventions. The fortification of salt or oil with iodine is the most common tool to prevent IDD. Iodized salt that is commercially packaged in plastic sacks and not stored properly can lose its concentration of iodine. Proper packaging and storage of iodized salt is essential to ensure that the population benefits from iodine fortification.

- **In Mali, 74 percent of children under five years live in a household that uses salt containing some iodine.** Use of iodized salt is lowest in the Kidal/Gao/Tombouctou region (27 percent) and is highest in Bamako (94 percent).

**Figure 10**  
**Children under Five Years Living in Households with Iodized Salt by Region, Mali**



## **Figure 11: Night Blindness among Mothers of Children under Five Years, Mali**

Globally, vitamin A deficiency (VAD) is the leading cause of childhood blindness. The damage to vision (xerophthalmia) is only one of the harmful outcomes of VAD. Vitamin A is crucial for rapid growth and recovery from illness or infection. Children who are vitamin A deficient have reduced immunity and are less likely to recuperate from common childhood illnesses, such as diarrhea, ARI, and measles, and are twice as likely to die as children who are not vitamin A deficient.

A mother's vitamin A status during pregnancy can be an indicator of the vitamin A status of her child. One sign of VAD in women during pregnancy is night blindness.

- **In Mali, 19 percent of all women who had given birth in the previous five years reported having some form of night blindness during their last pregnancy.**
- **However, only 6 percent of women reported having trouble with their vision during the night but not during the day during their last pregnancy.** Although this figure corrects for women with vision problems in general, it may slightly underestimate the rate of night blindness.

# Figure 11

## Night Blindness among Mothers of Children under Five Years, Mali

Nineteen percent of all women had reported some form of night blindness during their last pregnancy.

Six percent of women had trouble with their vision during the night but not during the day during their last pregnancy.



## **Figure 12: Vitamin A Supplementation among Mothers of Children under Five Years by Region, Mali**

Recent studies show that pregnant women who are vitamin A deficient are at a greater risk of dying during or shortly after delivery of the child. Pregnancy and lactation strain women's nutritional status and their vitamin A stores. For women who have just given birth, vitamin A supplementation helps to bring their level of vitamin A storage back to normal, aiding recovery and avoiding illness.

Vitamin A supplementation also benefits children who are breastfed. If mothers have vitamin A deficiency, their children can be born with low stores of vitamin A. Low birth weight babies are especially at risk. Additionally, infants often do not receive an adequate amount of vitamin A from breast milk when mothers are vitamin A deficient. Therefore, supplementation is important for postpartum women within the first eight weeks after childbirth.

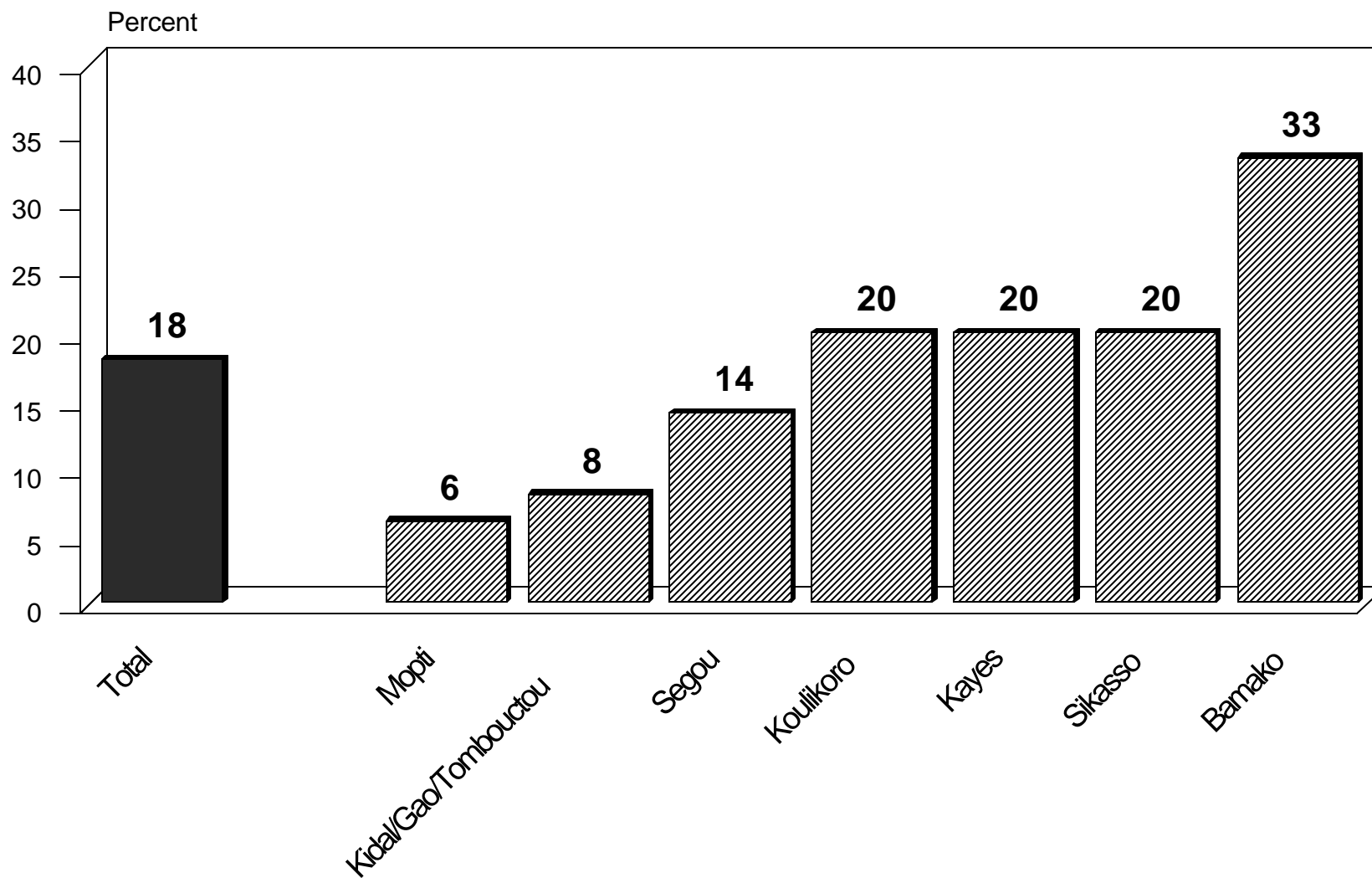
In Mali,

- **Eighteen percent of mothers received vitamin A supplements within two months after delivery.**
- **Vitamin A supplementation of mothers varies by region.** Only 6 percent of mothers in the Mopti region received vitamin A, while 33 percent of mothers in Bamako did.



# Figure 12

## Vitamin A Supplementation among Mothers of Children under Five Years by Region, Mali



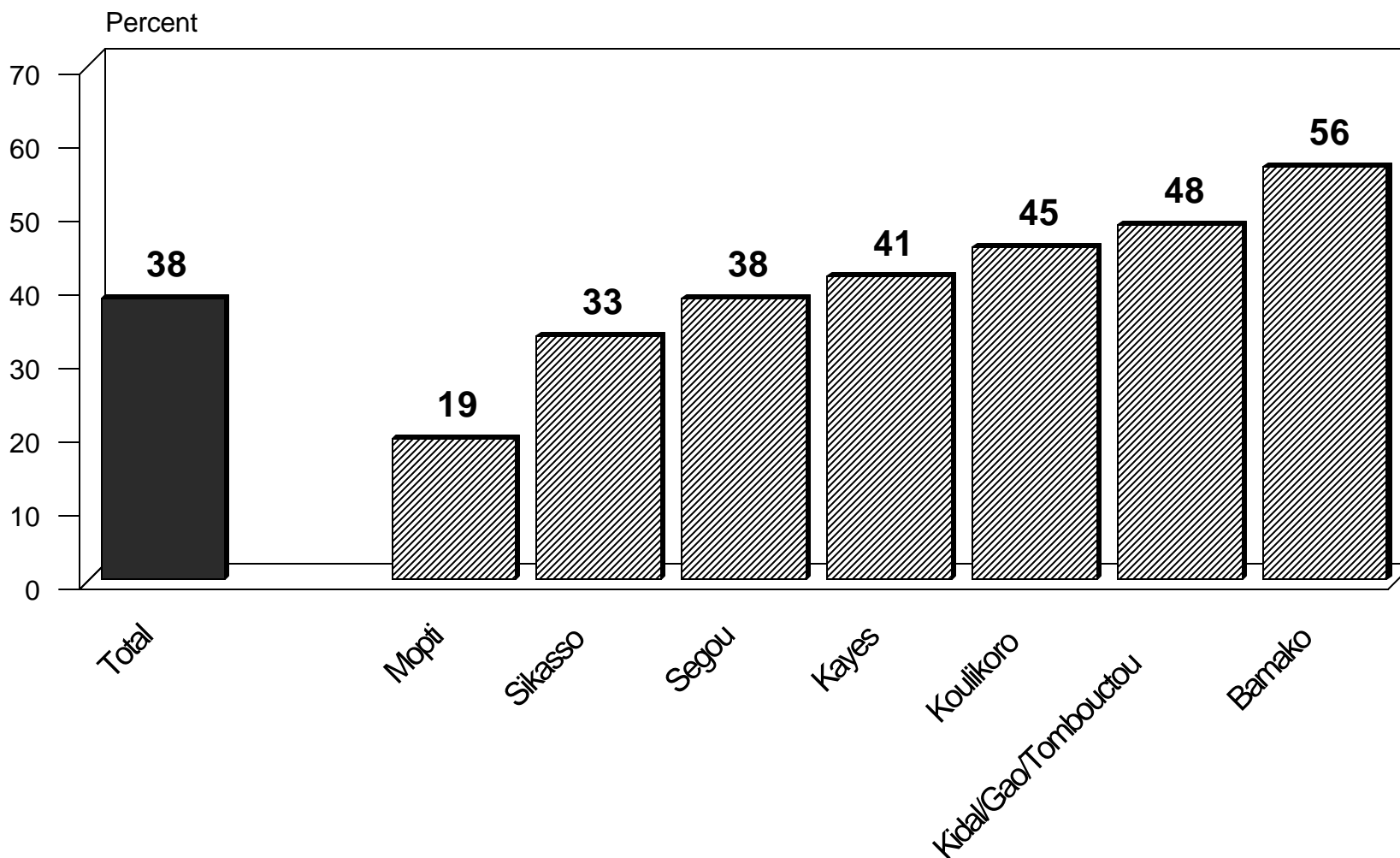
## **Figure 13: Vitamin A Supplementation among Children 6-59 Months in the Past Six Months by Region, Mali**

Vitamin A deficiency is common in dry environments where fresh fruits and vegetables are not readily available. Vitamin A is found in breast milk, other milks, liver, eggs, fish, butter, red palm oil, mangos, papayas, carrots, pumpkins, and dark leafy greens. Unlike iron or folate, vitamin A is a fat-soluble vitamin, which means that consumption of oils or fats is necessary for its absorption into the body. The liver can store an adequate amount of the vitamin for four to six months. Periodic dosing (every four to six months) with vitamin A supplements is a rapid, low-cost method of ensuring that children at risk do not develop VAD. National Immunization Days for polio or measles vaccinations are ideal for reaching a large number of children with vitamin A supplements.

In Mali,

- **Thirty-eight percent of children 6-59 months received a vitamin A dose in the last six months.**
- **The rate of vitamin A supplementation of children varies throughout Mali.** The rates of supplementation were lowest in the Mopti region (19 percent) and highest in Bamako (56 percent).

**Figure 13**  
**Vitamin A Supplementation among Children 6-59 Months in**  
**the Past Six Months by Region, Mali**



## **Figure 14: Iron Supplementation among Mothers of Children under Five Years, Mali**

Anemia is the lack of an adequate amount of hemoglobin in the blood. It can be caused by several different health conditions; iron and folate deficiencies are some of the most prevalent conditions related to anemia. Vitamin B<sub>12</sub> deficiency, protein deficiency, sickle cell disease, malaria, and parasite infection also cause anemia.

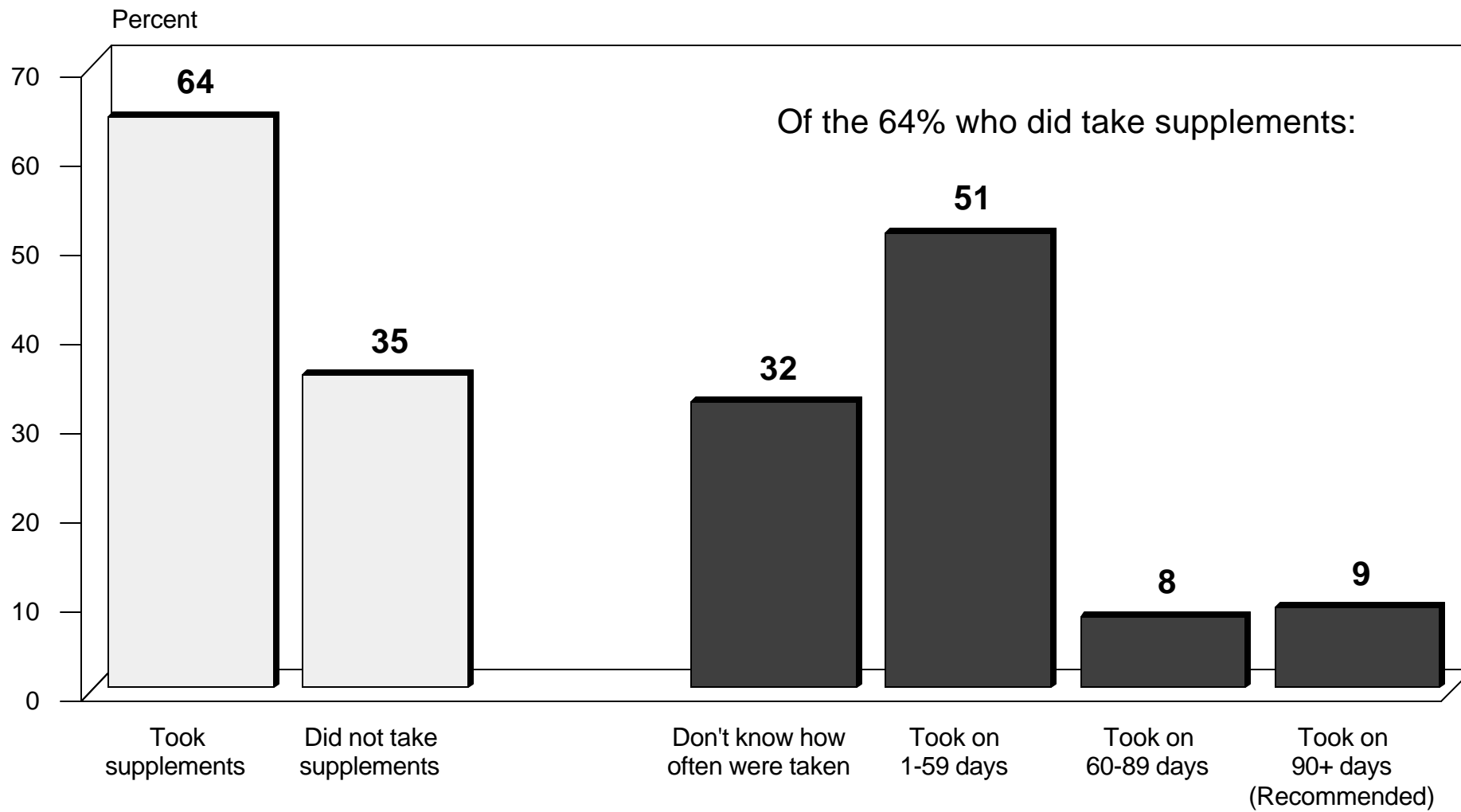
Iron-deficiency anemia is the most common form of nutritional deficiency worldwide. This type of nutritional deficiency develops slowly and does not manifest symptoms until anemia becomes severe. Diets that are heavily dependent on one grain or starch as the major staple often lack sufficient iron intake. Iron is found in meats, poultry, fish, grains, some cereals, and dark leafy greens (such as spinach). Foods rich in vitamin C increase absorption of iron into the blood. Tea, coffee, and whole-grain cereals can inhibit iron absorption. Anemia is common in children 6-24 months of age who consume purely a milk diet and in women during pregnancy and lactation. Iron-deficiency anemia is related to decreased cognitive development in children, decreased work capacity in adults, and limited chances of child survival. Severe cases are associated with the low birth weight of babies, perinatal mortality, and maternal mortality.

In Mali,

- **Sixty-four percent of mothers received some iron supplementation during pregnancy.**
- **Of those women who received iron supplementation, only 9 percent reported taking iron the recommended minimum number of days during their pregnancy (90 or more days).**

# Figure 14

## Iron Supplementation among Mothers of Children under Five Years, Mali



## **Figure 15: Iron-Deficiency Anemia in Children 6-59 Months and Mothers by Region, Mali**

To estimate the prevalence of iron-deficiency anemia in Mali, hemoglobin levels of children 6-59 months and women 15-49 were measured using the HemoCue method. Retractable disposable cuvettes were used to puncture the fingertip or heel to draw and hold blood. The cuvettes were placed in the HemoCue machine, which consists of a battery-operated photometer. The hemoglobin levels in the blood were analyzed and the results displayed in a digital register. The World Health Organization defines severe, moderate, and mild anemia in non-pregnant women as hemoglobin concentrations of <7.0 g/dl, 7.0-9.9 g/dl, and 10.0-11.9 g/dl, respectively. In children and pregnant women, the cutoffs for severe, moderate, and mild anemia are <7.0 g/dl, 7.0-9.9 g/dl, and 10.0-10.9 g/dl, respectively.<sup>1</sup>

In Mali,

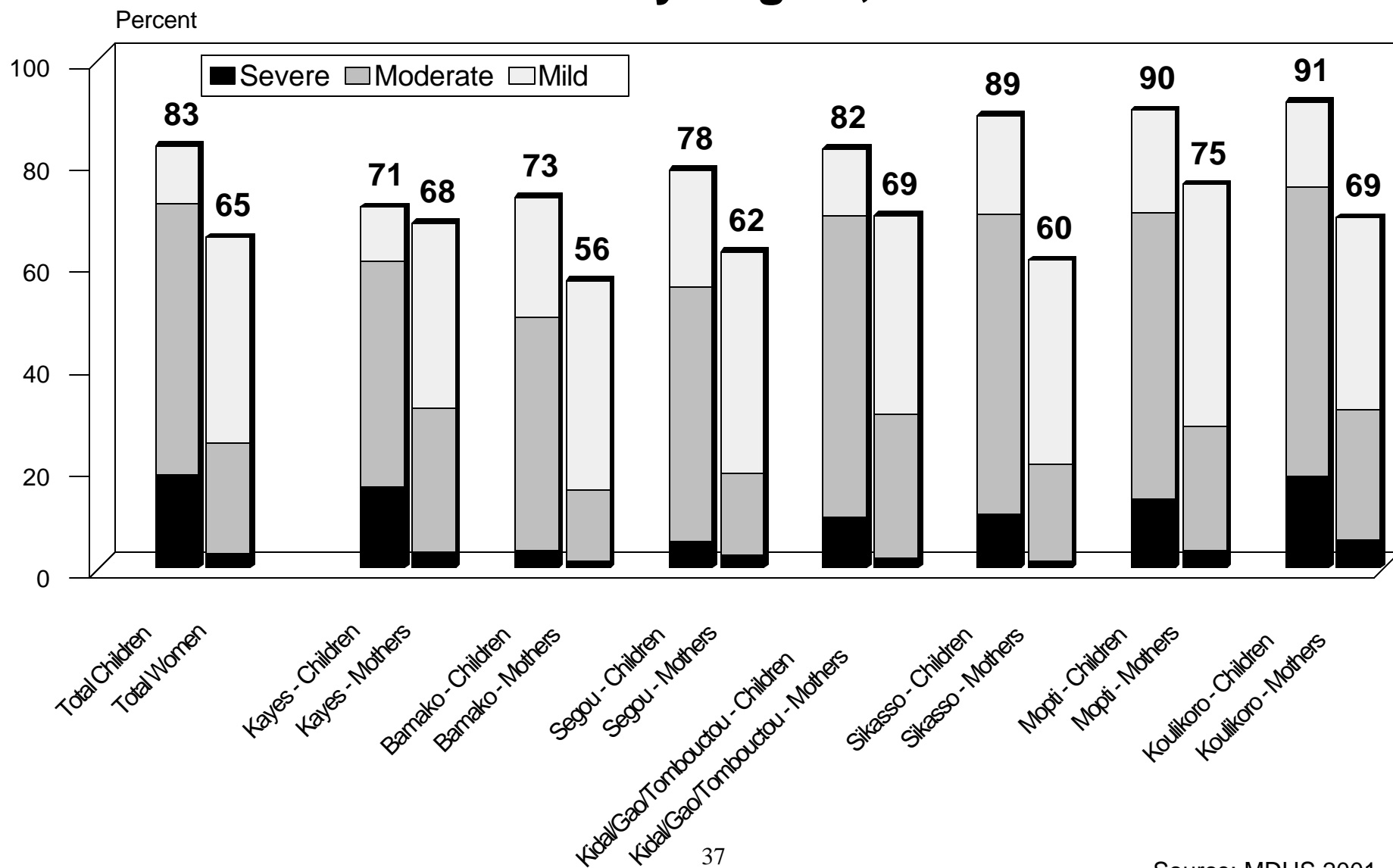
- **Eighty-three percent of children and 65 percent of mothers are anemic.**
- **Anemia rates for children are highest in the Koulikoro region (91 percent) and lowest in Kayes (71 percent).**
- **Anemia rates for mothers are highest in the Mopti region (75 percent) and lowest in Bamako (56 percent).**

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<sup>1</sup>World Health Organization. 1997. *Iron Deficiency: Indicators for Assessment and Strategies for Prevention*. Micronutrient Series. WHO/NUT/96.12. Geneva: WHO.

# Figure 15

## Iron-Deficiency Anemia in Children 6-59 Months and Mothers by Region, Mali



## **Figure 16: Diarrhea and Cough with Rapid Breathing among Children under Five Years Compared with Malnutrition Rates, Mali**

Acute respiratory infection and dehydration due to diarrhea are major causes of morbidity and mortality in most sub-Saharan countries. To estimate the prevalence of ARI, mothers were asked whether their children under five years had been ill with coughing accompanied by short, rapid breathing in the past two weeks. For diarrhea, mothers were asked whether their children under five years had symptoms of diarrhea in the past two weeks. Early diagnosis and rapid treatment can reduce the rates of illness or death caused by these conditions.

In Mali,

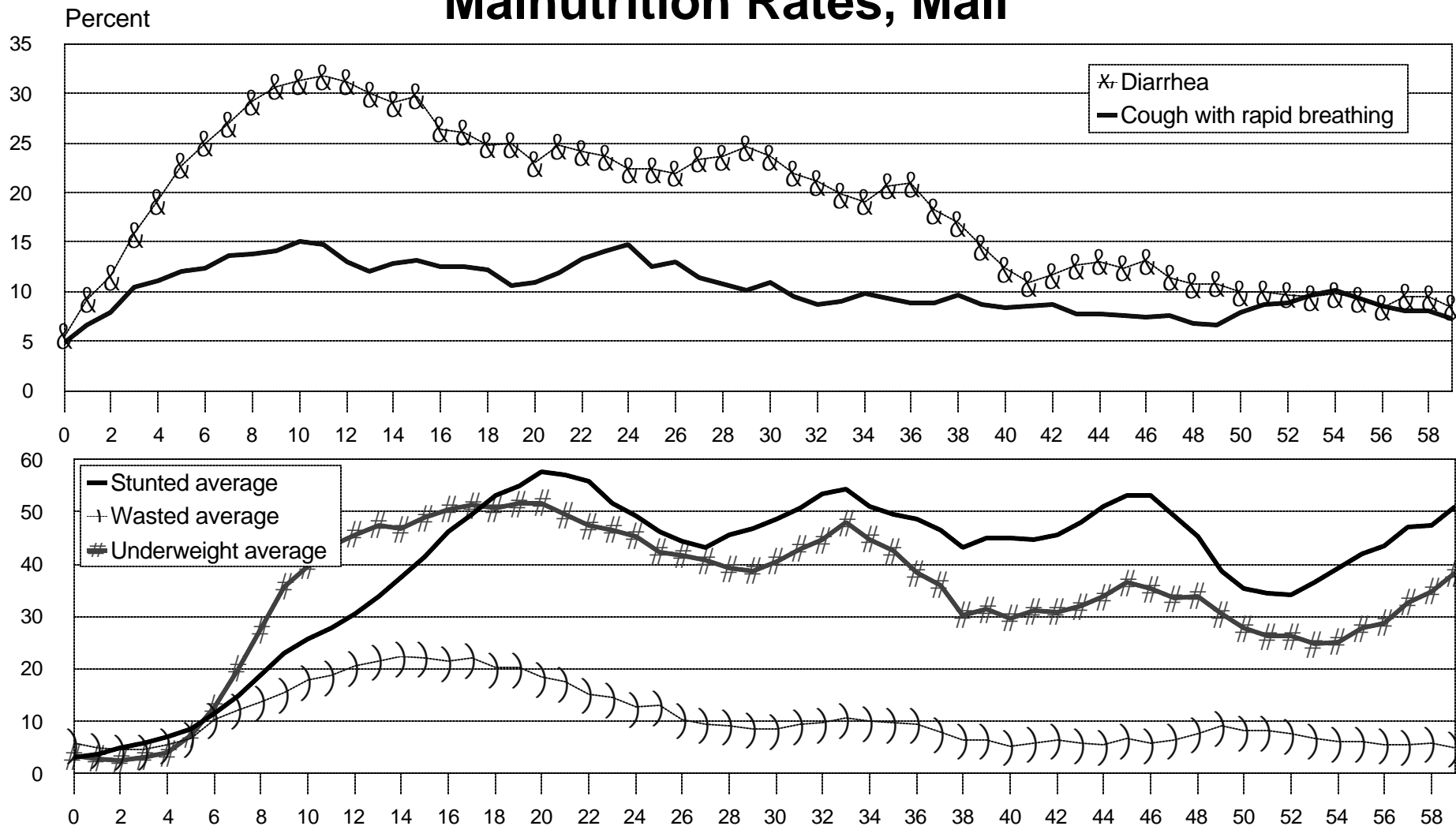
- **Ten percent of children under five years of age experienced cough with rapid breathing in the two weeks preceding the survey.** Mali's prevalence of cough with rapid breathing increases from 5 percent to 15 percent in the first 10 months and then gradually declines to 7 percent by 49 months of age, increases to 10 percent at 54 months, then decreases back to 7 percent at 59 months.
- **Nineteen percent of children under five years of age had diarrhea in the two weeks preceding the survey.** The prevalence of diarrhea increases rapidly from birth to 11 months, when it peaks at 32 percent. The rate then decreases steadily to 9 percent by 59 months.

The rapid rise in the prevalence of diarrhea during infancy reflects the increased risk of pathogen contamination associated with the early introduction of water, other liquids, and solid foods. In addition, when infants begin to crawl and move around, they tend to put objects in their mouth, again increasing the risk of pathogen contamination.



# Figure 16

## Diarrhea and Cough with Rapid Breathing among Children under Five Years Compared with Malnutrition Rates, Mali



Note: Plotted values are smoothed by a five-month moving average.

# Underlying Biological and Behavioral Influences of Malnutrition

## Figure 17: Fertility and Birth Intervals, Mali Compared with Other Sub-Saharan Countries

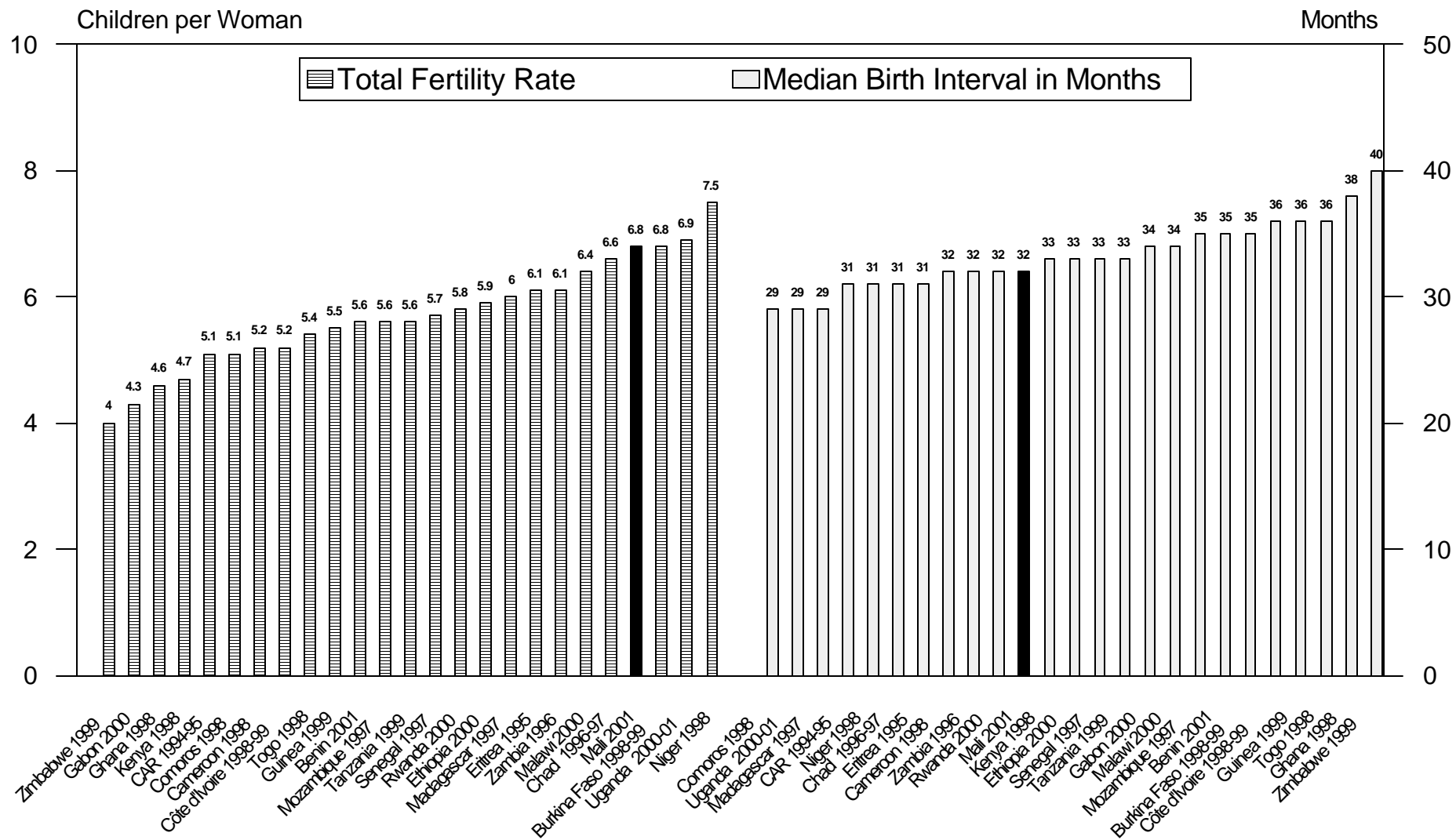
High fertility rates, especially when accompanied by short birth intervals, are detrimental to children's nutritional status. In most countries in sub-Saharan Africa, families have scarce resources to provide adequate nutrition and health care for their children. As the number of children per woman increases, fewer household resources are available for each child. High fertility also has a negative impact on maternal health, thus influencing a mother's ability to adequately care for her children. The most widely used measure of current fertility is the total fertility rate, which is defined as the number of children a woman would have by the end of her childbearing years if she were to pass through those years bearing children at the currently observed age-specific rates.

Information on the length of birth intervals provides insight into birth spacing patterns. Research has shown that children born too soon after a previous birth are at increased risk of poor nutrition and health and increased risk of mortality, particularly when that interval is less than 24 months. The odds of stunting and underweight have been shown to be higher when birth intervals are less than 36 months. Short birth intervals are associated with small birth size and low birth weight, both of which are precursors to poor nutritional status in early childhood.

- **At current fertility rates, a woman in Mali will have an average of 6.8 children by the end of her childbearing years.** This rate is in the high end of the sub-Saharan countries surveyed between 1994 and 2001.
- **Mali's mothers have a median birth interval of 32 months.** This interval is in the midrange of the countries surveyed.

# Figure 17

## Fertility and Birth Intervals, Mali Compared with Other Sub-Saharan Countries



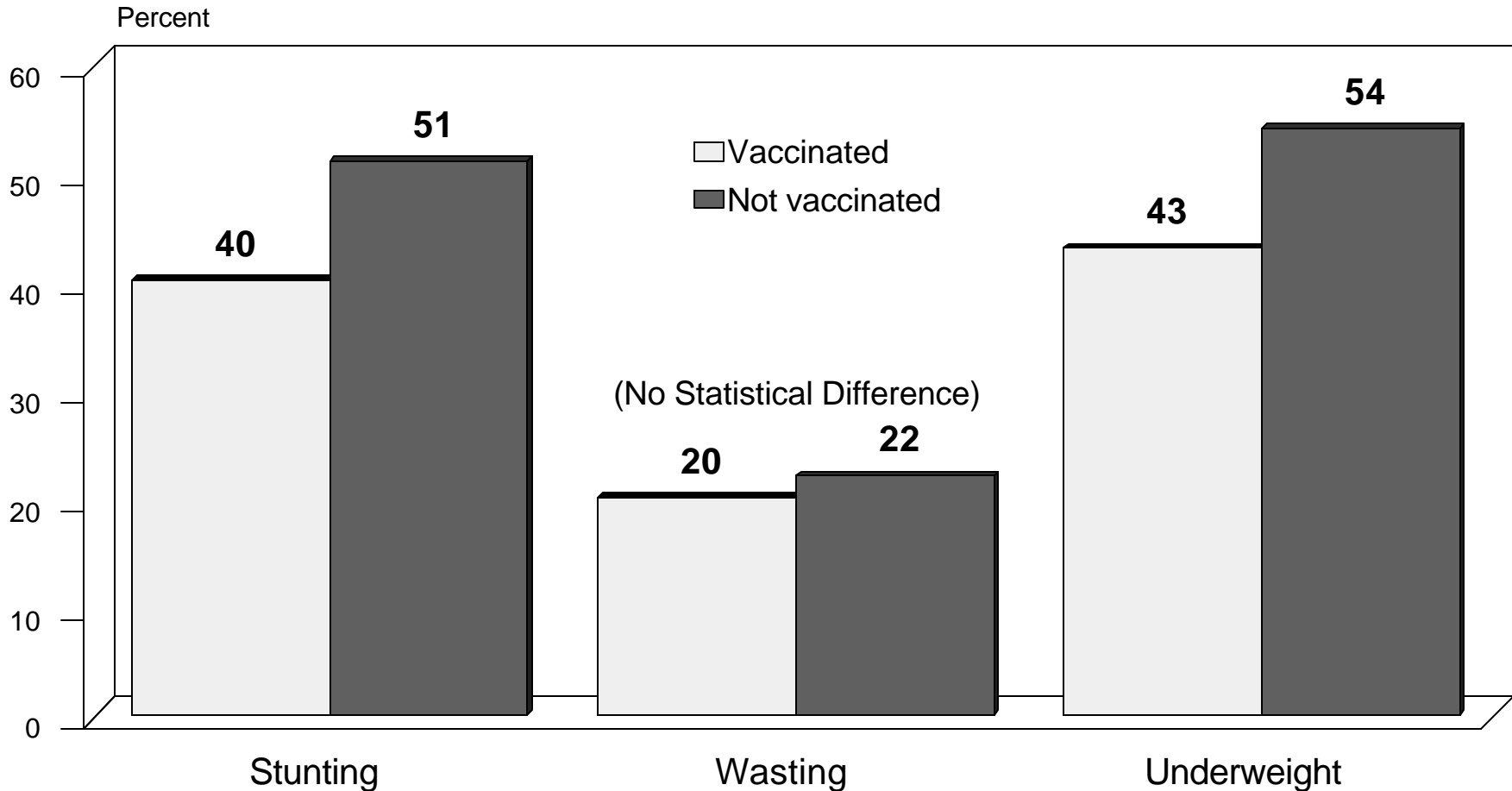
## **Figure 18: Undernutrition among Children Age 12-23 Months by Measles Vaccination Status, Mali**

Measles is estimated to kill two million children a year, all in developing countries. It is one of the most common diseases during childhood in areas with low immunization coverage. Measles not only increases the risk of death but also is a direct cause of malnutrition. The occurrence of measles in poor environments is associated with faltering growth, vitamin A deficiency, and immune suppression. Although infants are not protected from measles by their mother's breast milk, they are protected by their mother's measles antibodies acquired while in the womb. These antibodies can last up to 15 months in infants, but due to malnutrition, last only eight or nine months in children in developing countries. Therefore, measles vaccination is an important child health strategy.

- **In Mali, chronic malnutrition is statistically related to measles vaccination status.** Stunting is 11 percent higher among children who did not receive a measles vaccination than among those who did.
- **In Mali, undernutrition is statistically related to measles vaccination status.** Underweight is 12 percent higher among children who did not receive a measles vaccination than among those who did.
- **Wasting is not statistically related to measles vaccination status.**

# Figure 18

## Undernutrition among Children Age 12-23 Months by Measles Vaccination Status, Mali



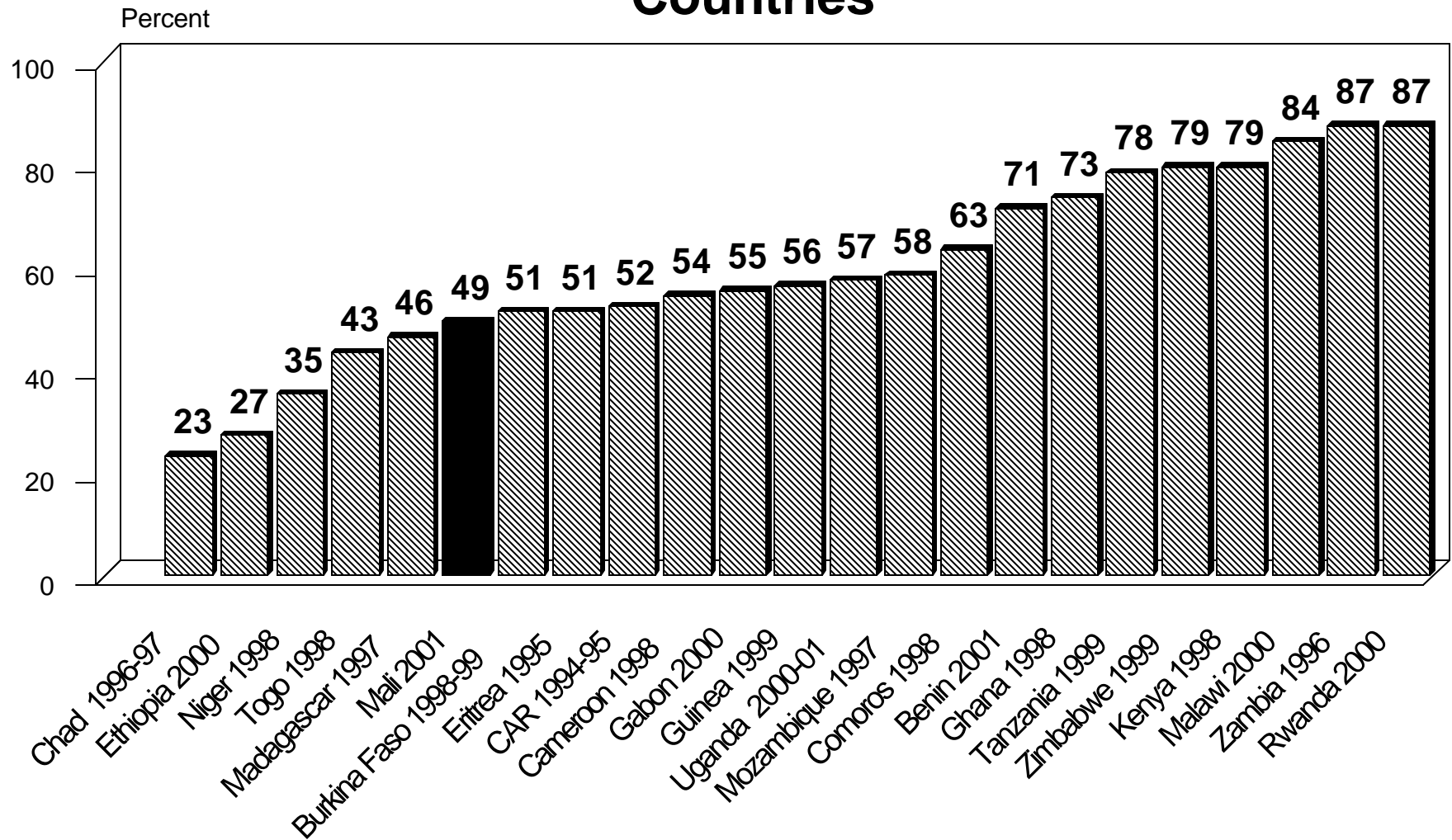
Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both.

## **Figure 19: Measles Vaccination Coverage among Children Age 12-23 Months, Mali Compared with Other Sub-Saharan Countries**

- The prevalence of measles vaccination ranges from 23 to 87 percent among the sub-Saharan countries surveyed.
- **In Mali, 49 percent of children 12-23 months of age have been vaccinated against measles.** This level of coverage is in the low range among the sub-Saharan countries surveyed.

# Figure 19

## Measles Vaccination Coverage among Children Age 12-23 Months, Mali Compared with Other Sub-Saharan Countries





## Figure 20: Feeding Practices for Infants under Six Months, Mali

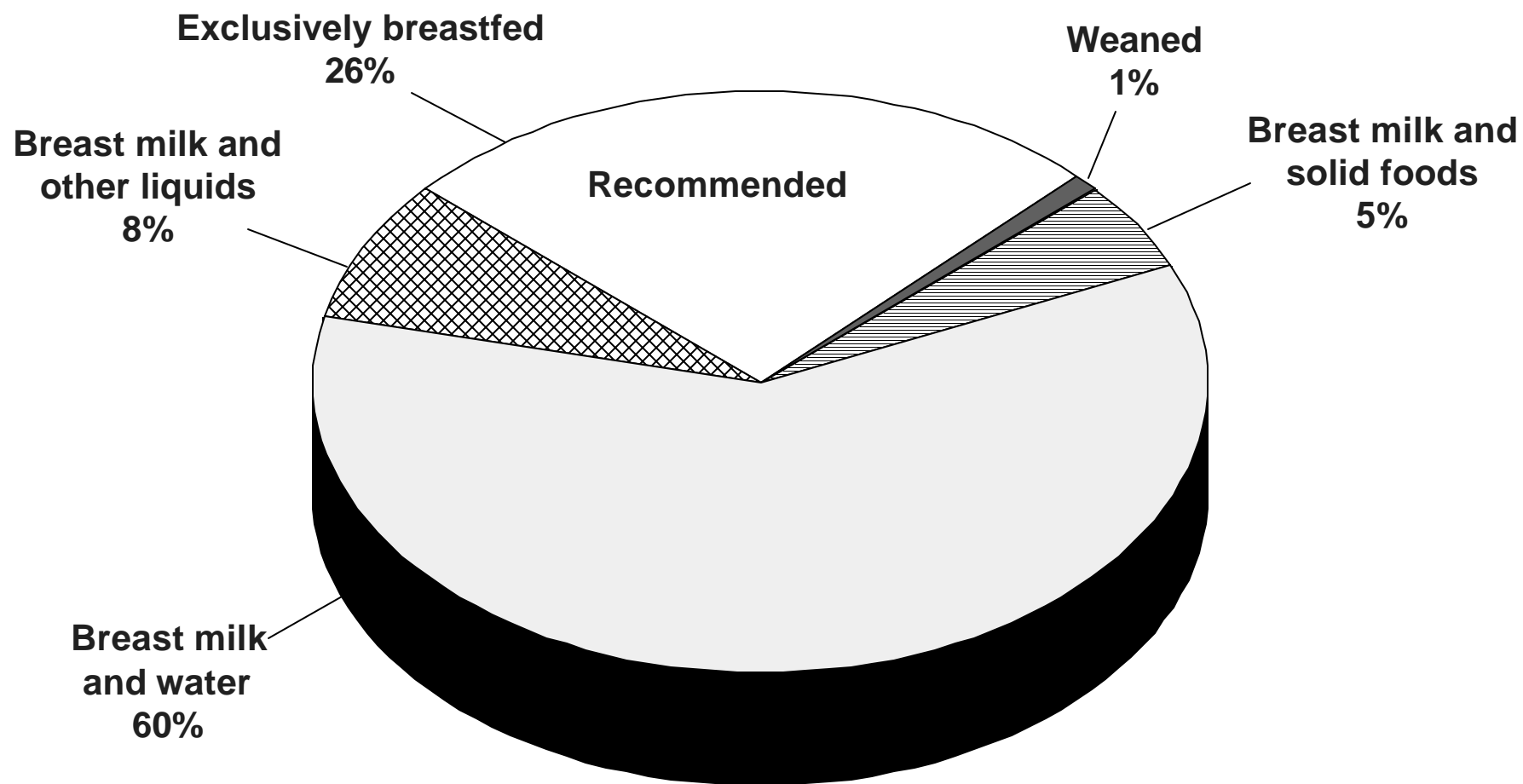
Improper feeding practices, in addition to diarrheal disease, are important determinants of malnutrition. WHO and UNICEF recommend that *all infants be exclusively breastfed from birth until six months of age*. In other words, infants should be fed only breast milk during the first six months of life.

In Mali, the introduction of liquids, such as water, sugar water, and juice; formula; and solid foods takes place earlier than the recommended age of about six months. This practice has a deleterious effect on nutritional status for a number of reasons. First, the liquids and solid foods offered are nutritionally inferior to breast milk. Second, the consumption of liquids and solid foods decreases the infant's intake of breast milk, which in turn reduces the mother's supply of milk. (Breast milk production is determined, in part, by the frequency and intensity of suckling.) Third, feeding young infants liquids and solid foods increases their exposure to pathogens, thus putting them at greater risk of diarrheal disease.

- **In Mali, only 26 percent of children under the age of six months are exclusively breastfed, as is recommended by WHO and UNICEF.**
- **Thirteen percent of infants under six months old are given some form of liquid or solid food other than breast milk and/or water. Additionally, 60 percent of infants under six months of age are given a combination of breast milk and water.**
- **One percent of infants under six months are fully weaned.**

# Figure 20

## Feeding Practices for Infants under Six Months, Mali



Note: WHO and UNICEF recommend that all infants be breastfed exclusively up to six months of age.

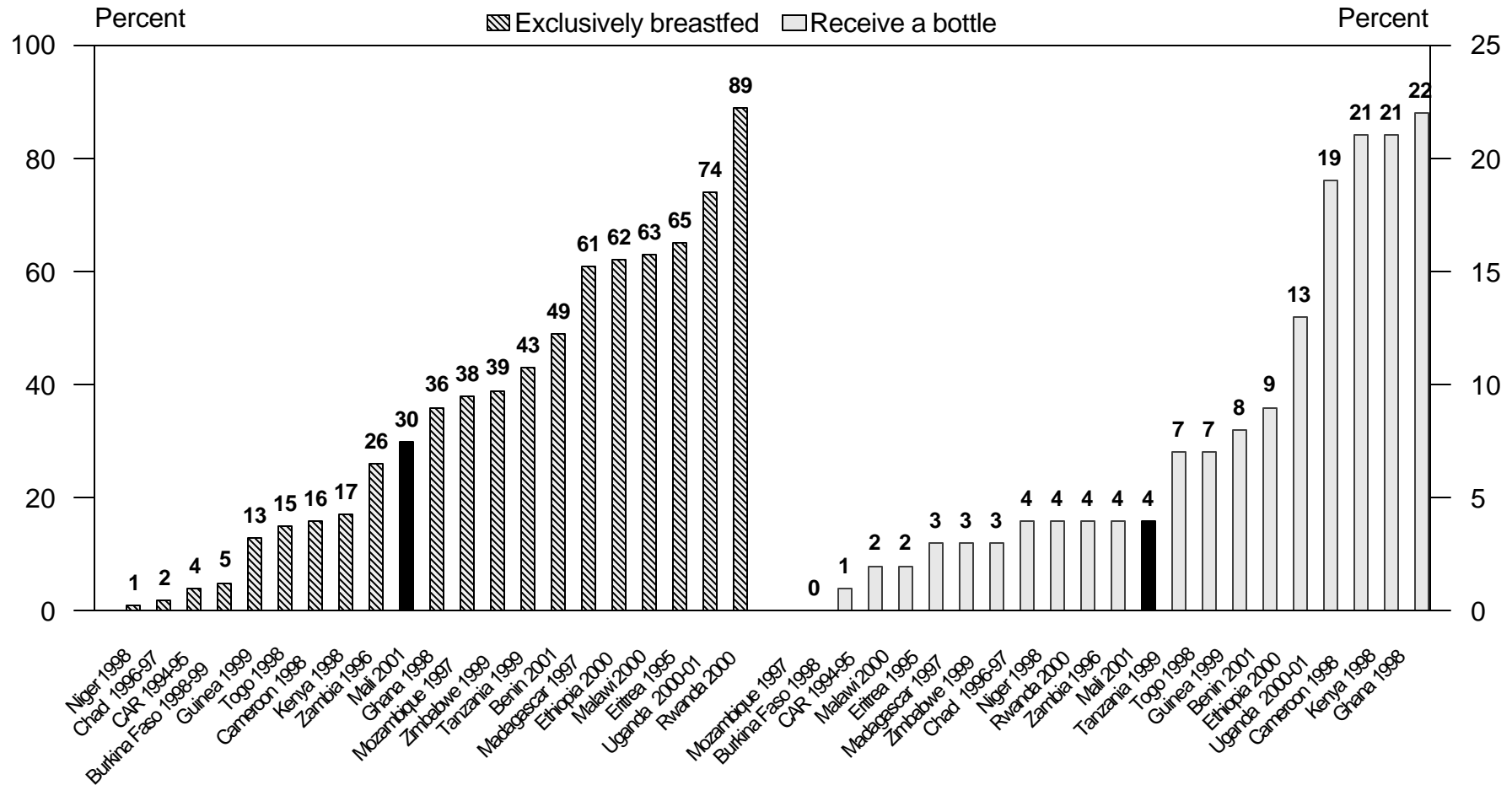
## **Figure 21: Infants under Four Months Who Are Exclusively Breastfed and Those Who Receive a Bottle, Mali Compared with Other Sub-Saharan Countries**

The failure to exclusively breastfeed young infants, and the introduction of liquids and solid foods at too early an age, increases the risk of diarrheal disease, an important cause of mortality in Africa.

- In most of the sub-Saharan countries surveyed, relatively few mothers of infants under four months follow the recommended practice of breastfeeding exclusively. **In Mali, 30 percent of these mothers breastfeed their young infants exclusively.** This puts Mali in the midrange of the sub-Saharan countries surveyed and is a substantial increase from 1995-96 (12 percent).
- **Bottle-feeding is practiced by 4 percent of mothers of infants under four months in Mali.** This rate is in the midrange among the countries surveyed and is a slight increase from 1996 (3 percent). **Bottle-feeding is not recommended,** because improper sanitation and formula preparation with bottle-feeding can introduce pathogens to the infant, putting the child at a greater risk of illness and malnutrition.

# Figure 21

## Infants under Four Months Who Are Exclusively Breastfed and Those Who Receive a Bottle, Mali Compared with Other Sub-Saharan Countries



Note: Information on feeding practices is based on the 24 hours before the survey. WHO and UNICEF recommend that all infants should receive nothing but breast milk up to six months of age.

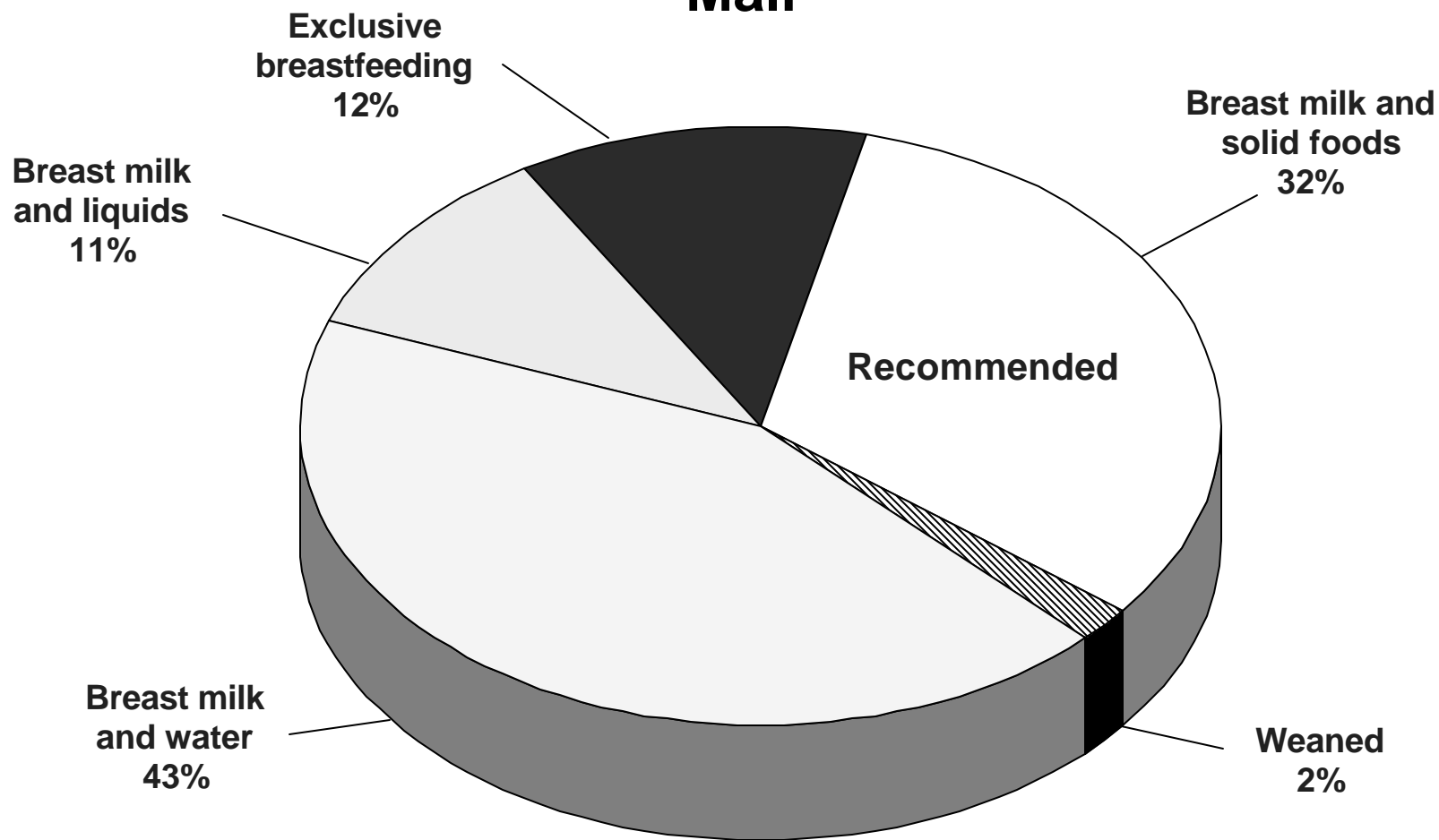
## Figure 22: Feeding Practices for Infants Age 6-9 Months, Mali

UNICEF and WHO recommend that solid foods be introduced to infants around the age of six months because, at that age, breast milk alone is no longer sufficient to maintain a child's optimal growth. Thus, *all infants over six months of age should receive solid foods* along with breast milk.

- **In Mali, 32 percent of infants age 6-9 months are fed solid foods in addition to breast milk.** This means that only about one-third of all infants age 6-9 months are fed according to the recommended practice.
- **Sixty-six percent of infants age 6-9 months are not fed solid foods in addition to breast milk, putting these children at risk for malnutrition.**
- **Two percent of infants age 6-9 months are fully weaned** and are thus not receiving the additional nutritional and emotional support of breastfeeding.

# Figure 22

## Feeding Practices for Infants Age 6-9 Months, Mali



Note: WHO and UNICEF recommend that by the age of six months all infants should receive solid foods and liquids in addition to breast milk.

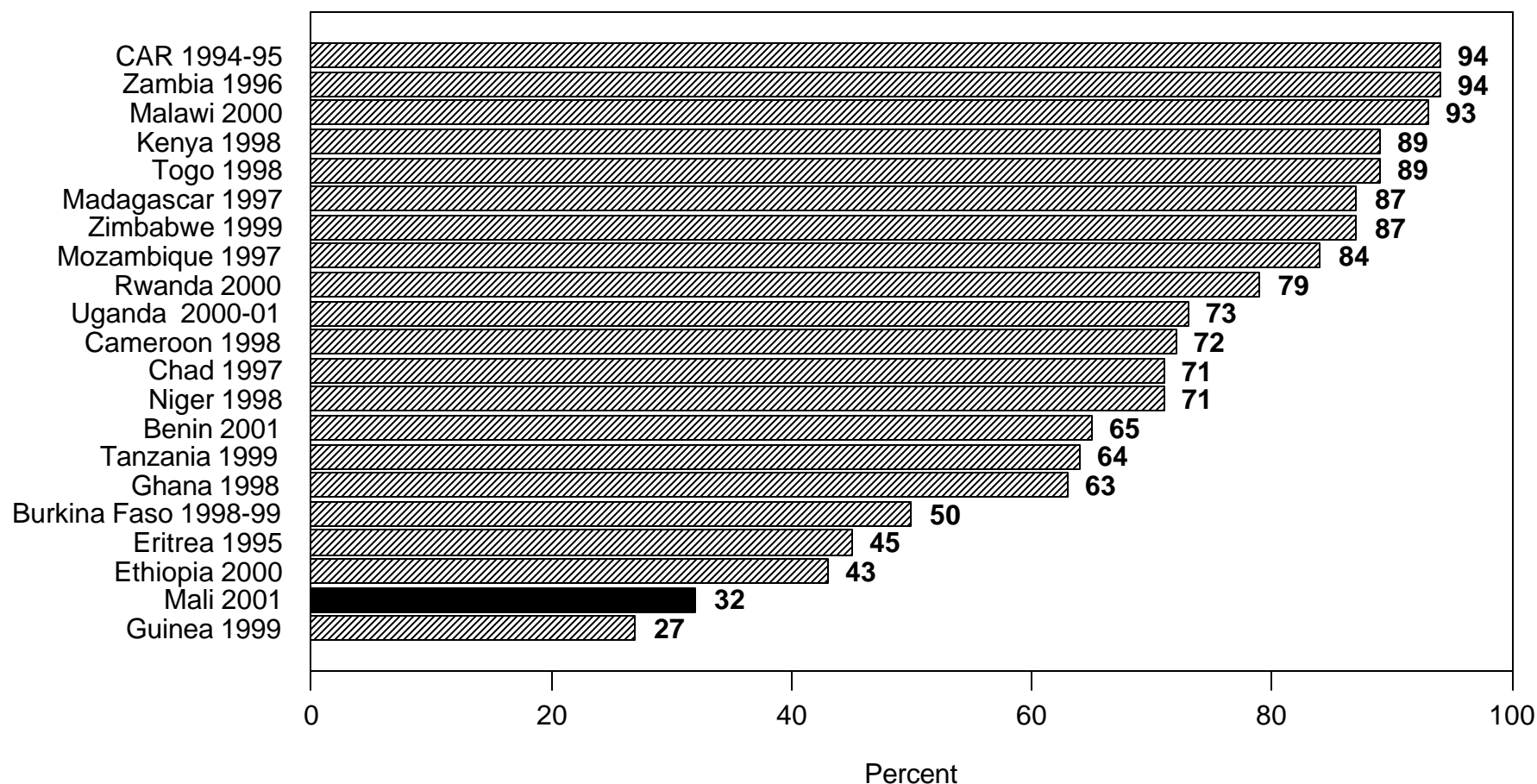
## **Figure 23: Infants Age 6-9 Months Receiving Solid Foods in Addition to Breast Milk, Mali Compared with Other Sub-Saharan Countries**

Optimal infant feeding practices include the introduction of complementary foods at about six months of age. The introduction of complementary feeding is necessary because, at that age, breast milk is no longer sufficient to satisfy the developing infant's energy, protein, and micronutrient needs. All infants age 6-9 months should receive complementary foods in addition to breast milk.

- The percentage of infants 6-9 months receiving solid food in addition to breast milk ranges from 27 to 94 percent among the sub-Saharan countries surveyed.
- In Mali, **32 percent of infants age 6-9 months receive solid food in addition to breast milk.** This is one of the lowest among all sub-Saharan countries surveyed.

# Figure 23

## Infants Age 6-9 Months Receiving Solid Foods in Addition to Breast Milk, Mali Compared with Other Sub-Saharan Countries



Note: WHO and UNICEF recommend that by the age of six months all infants should receive solid foods and liquids in addition to breast milk.



## **Figure 24: Children 10-23 Months Who Continue to Be Breastfed, Mali Compared with Other Sub-Saharan Countries**

For older infants and toddlers, breast milk continues to be an important source of energy, protein, and micronutrients. Studies have shown that in some populations, breast milk is the most important source of vitamin A and fat among children over 12 months of age. Breastfeeding older infants also reduces their risk of infection, especially those that cause diarrhea.

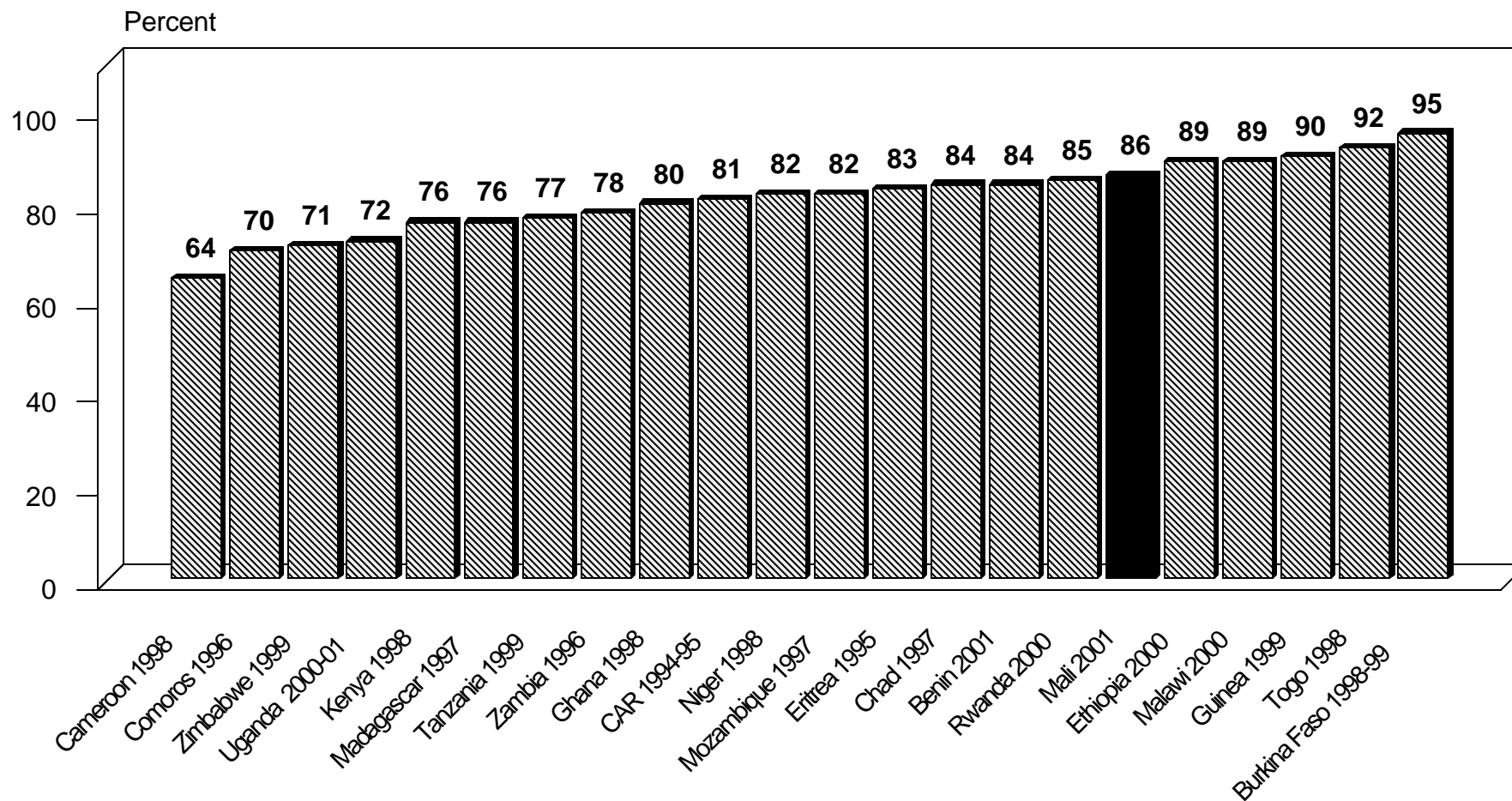
Additionally, breastfeeding up to 24 months can help reduce a woman's fertility, especially in areas where contraception is limited. Women who breastfeed for longer periods have lower fertility rates than women who breastfeed for shorter periods.

In Mali,

- **Eighty-six percent of children age 10-23 months are still given breast milk.** This is in the upper third of the sub-Saharan countries surveyed.

# Figure 24

## Children 10-23 Months Who Continue to Be Breastfed, Mali Compared with Other Sub-Saharan Countries



Note: Information on feeding practices is based on the 24 hours before the survey. WHO and UNICEF recommend that all children should continue to be breastfed up to 24 months of age.

# Underlying Social and Economic Influences of Malnutrition

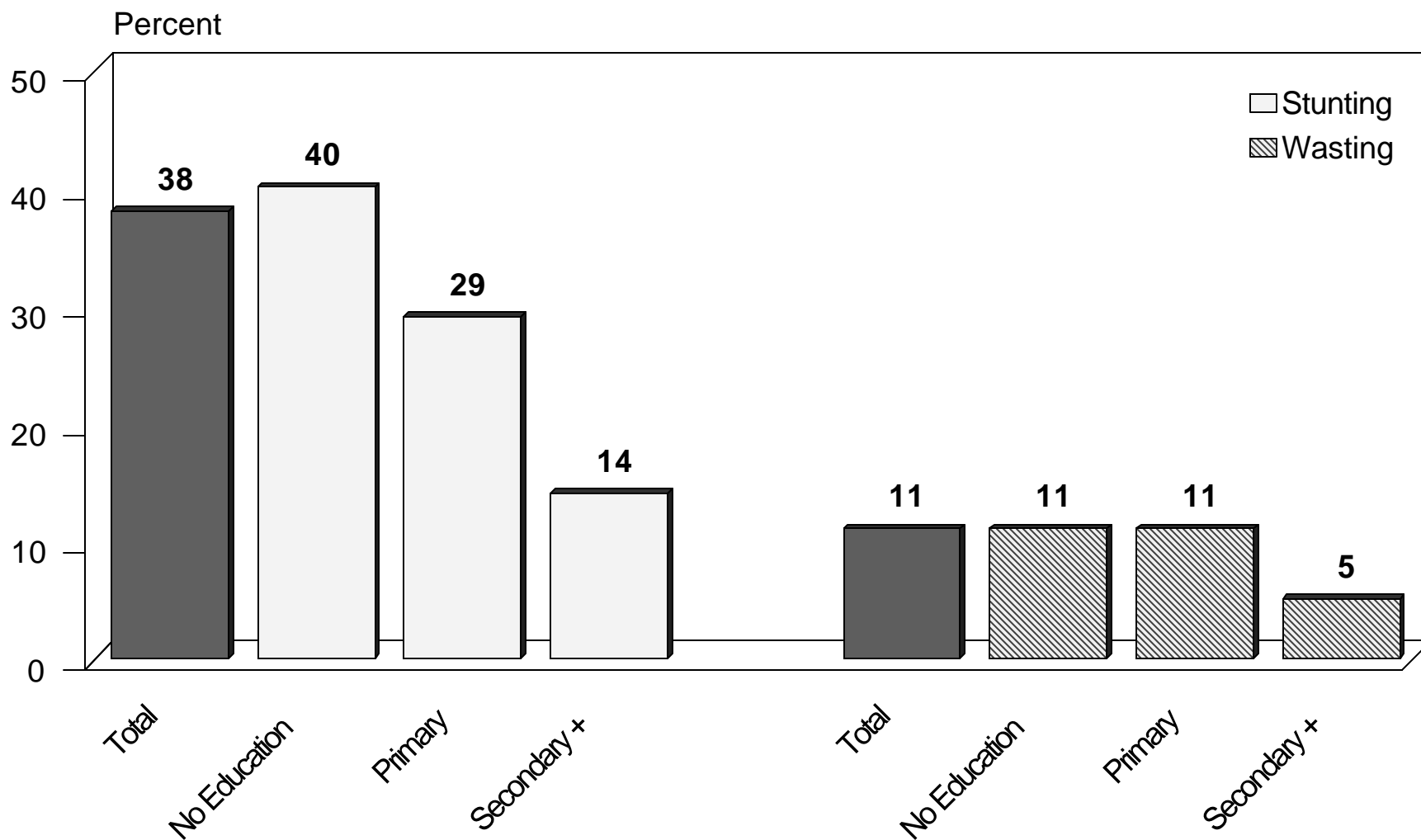
## Figure 25: Stunting and Wasting among Children under Five Years by Mother's Education, Mali

Maternal education is related to knowledge of good child care practices and to household wealth. In Mali, 84 percent of the mothers of children under five years of age have never attended school, while 11 percent have some primary education and 5 percent have a secondary or higher education. There are variations in school attendance, especially between urban and rural areas. In the rural areas, 90 percent of the mothers have never attended school, 9 percent have attended primary school, and only 1 percent have gone to secondary school or higher. In contrast, 52 percent of mothers in the capital and large cities and 76 percent of the mothers in small cities and towns have never attended school, while 22 percent in the capital and large cities and 15 percent in small cities and towns have gone to secondary school or higher. Mothers in Bamako had the highest likelihood of receiving at least a secondary school education (26 percent), compared to 1 to 4 percent in the rest of Mali's regions.

- Maternal education has an inverse relationship with stunting and wasting in Mali. **As the level of maternal education increases, the level of stunting and wasting decreases.**
- The difference in the level of stunting between children of mothers with no education and those whose mothers have a primary education is 11 percent. The difference between children of mothers with no education and children of mothers with a secondary education or higher is 26 percent.
- The difference in the level of wasting between children of mothers with no education and those with a secondary education or higher is 6 percent.

## Figure 25

### Stunting and Wasting among Children under Five Years by Mother's Education, Mali



Note: *Stunting* reflects chronic malnutrition;  
*wasting* reflects acute malnutrition

## **Figure 26: Stunting and Wasting among Children under Five Years by Source of Drinking Water, Mali**

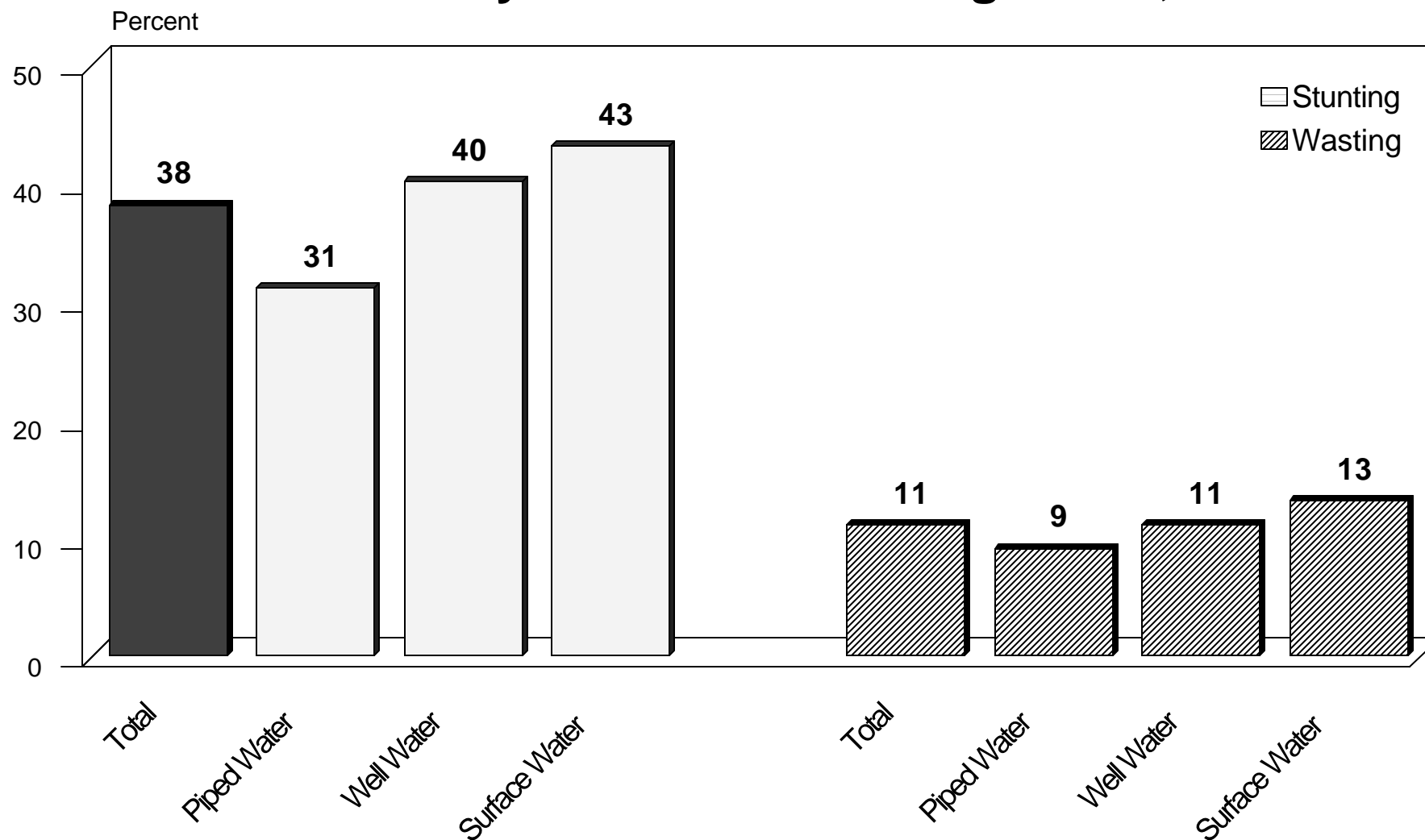
A household's source of drinking water is linked with its socioeconomic status. Poor households are more likely to obtain drinking water from contaminated sources such as surface water or open wells. Without an adequate supply of good-quality water, the risks of food contamination, diarrheal disease, and malnutrition rise. Infants and children from households that do not have a private tap are at greater risk of being malnourished than those from households with this amenity. Among the households surveyed with children under five years, 28 percent use piped water, 67 percent obtain their drinking water from a well, and 5 percent use surface water.

In Mali,

- **Children whose drinking water is well water or surface water are more likely to be stunted (40 and 43 percent, respectively) than children with access to piped water (31 percent).**
- **Children whose drinking water is well water or surface water are more likely to be wasted (11 percent or 13 percent, respectively) than children with access to piped water (9 percent).**

## Figure 26

### Stunting and Wasting among Children under Five Years by Source of Drinking Water, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition.

## **Figure 27: Stunting and Wasting among Children under Five Years by Type of Toilet, Mali**

The type of toilet used by a household reflects its wealth, and poor households are less likely to have adequate toilet facilities. Inadequate sanitation facilities result in an increased risk of diarrheal disease, which contributes to malnutrition. Infants and children from households that do not have ready access to a flush toilet are at greater risk of being malnourished than children from households with this amenity. In Mali, 75 percent of households have access to a latrine, 20 percent have no facilities, and 5 percent of surveyed households have access to a flush toilet.

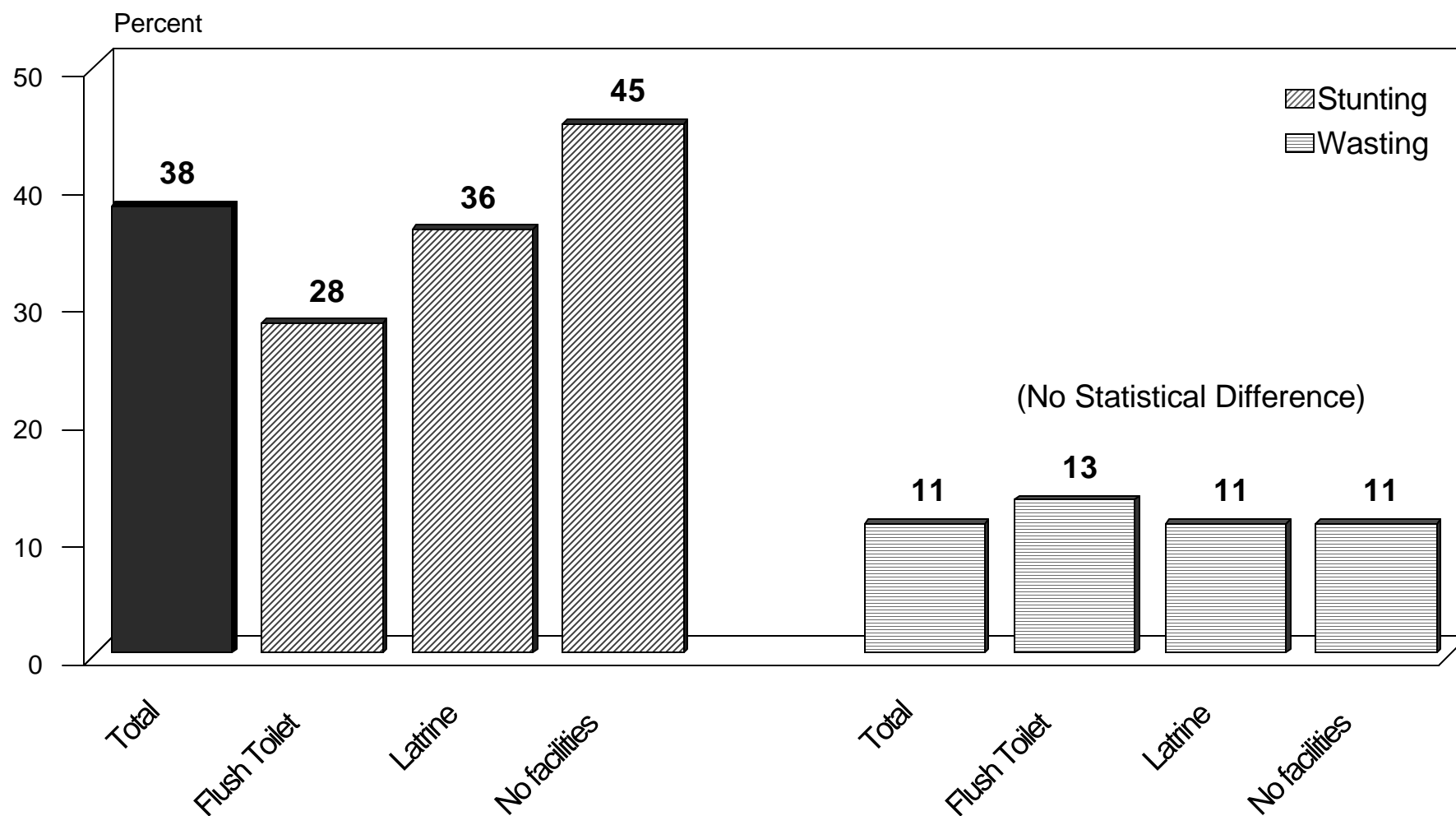
In Mali,

- Children who have no access to toilet facilities or those who have access to a latrine are more likely to be stunted (45 percent and 36 percent are stunted, respectively) than children with access to a flush toilet (28 percent).
- There is no statistical relationship between type of toilet and wasting.



## Figure 27

### Stunting and Wasting among Children under Five Years by Type of Toilet, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition.

# Basic Influences

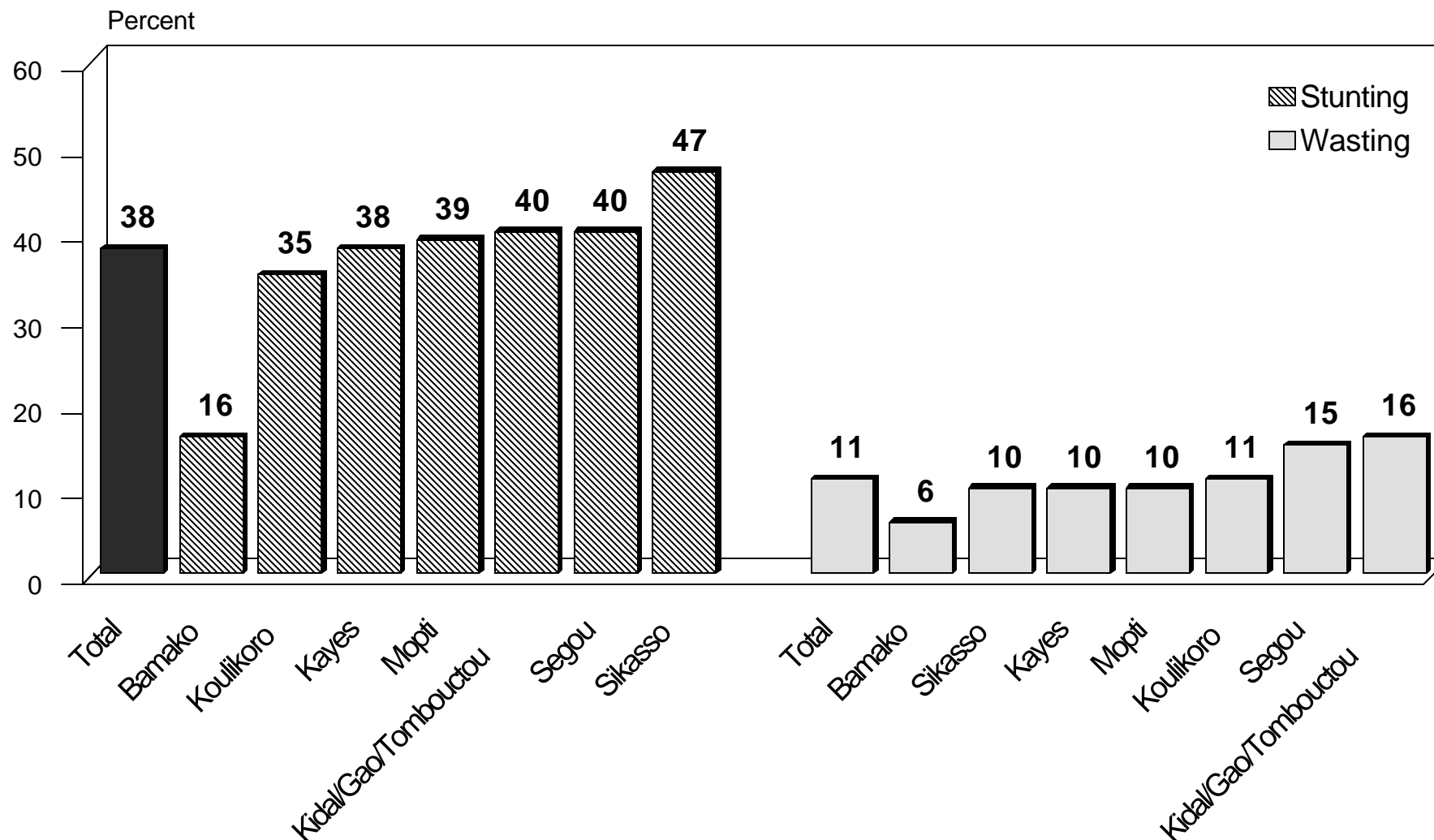
## Figure 28: Stunting and Wasting among Children under Five Years by Region, Mali

In Mali,

- **Stunting ranges from 16 to 47 percent among children in the 7 regions.** Stunting rates were the lowest in Bamako (16 percent) and the highest in the Sikasso region (47 percent).
- **Wasting ranges from 6 to 16 percent among children in the 7 regions.** Wasting rates were the lowest in the Bamako region (6 percent) and the highest in the joint Kidal/Goa/Tombouctou regions (16 percent).

# Figure 28

## Stunting and Wasting among Children under Five Years by Region, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition.

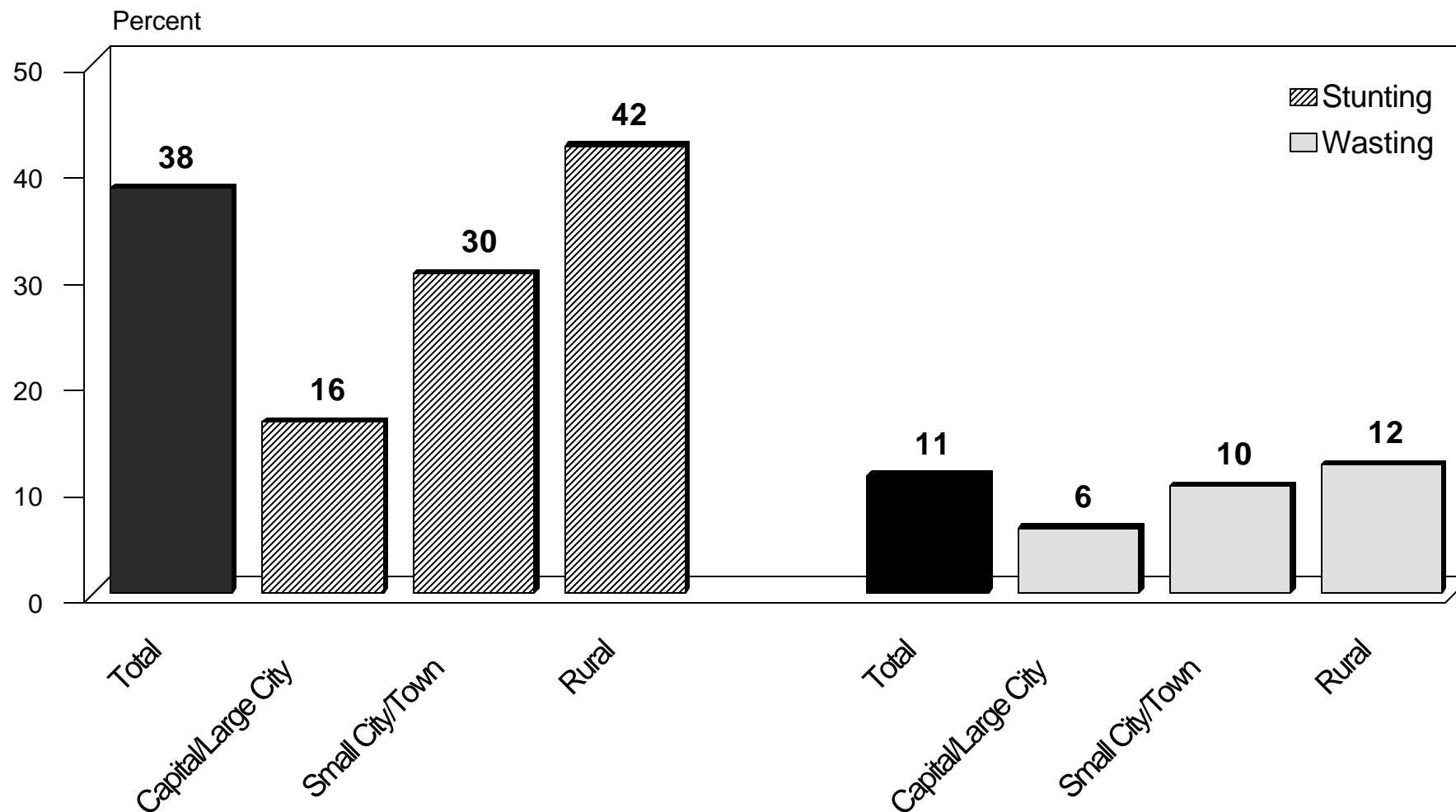
## Figure 29: Stunting and Wasting among Children under Five Years by Urban-Rural Residence, Mali

In Mali,

- **Forty-two percent of rural children are stunted.** In the capital and other large cities, 16 percent of children are affected by chronic malnutrition, and in other urban areas (small cities or towns), the rate of stunting is 30 percent.
- **Twelve percent of rural children are wasted.** In the capital and other large cities, 6 percent of children are affected by acute malnutrition, and in other urban areas (small cities or towns), the rate of wasting is 10 percent.

## Figure 29

### Stunting and Wasting among Children under Five Years by Urban-Rural Residence, Mali



Note: *Stunting* reflects chronic malnutrition; *wasting* reflects acute malnutrition.

# Maternal Nutritional Status

## **Figure 30: Malnutrition among Mothers of Children under Five Years by Region, Mali**

Besides being of concern in its own right, a mother's nutritional status affects her ability to successfully carry, deliver, and care for her children. There are generally accepted standards that can be applied for indicators of malnutrition among adult women.

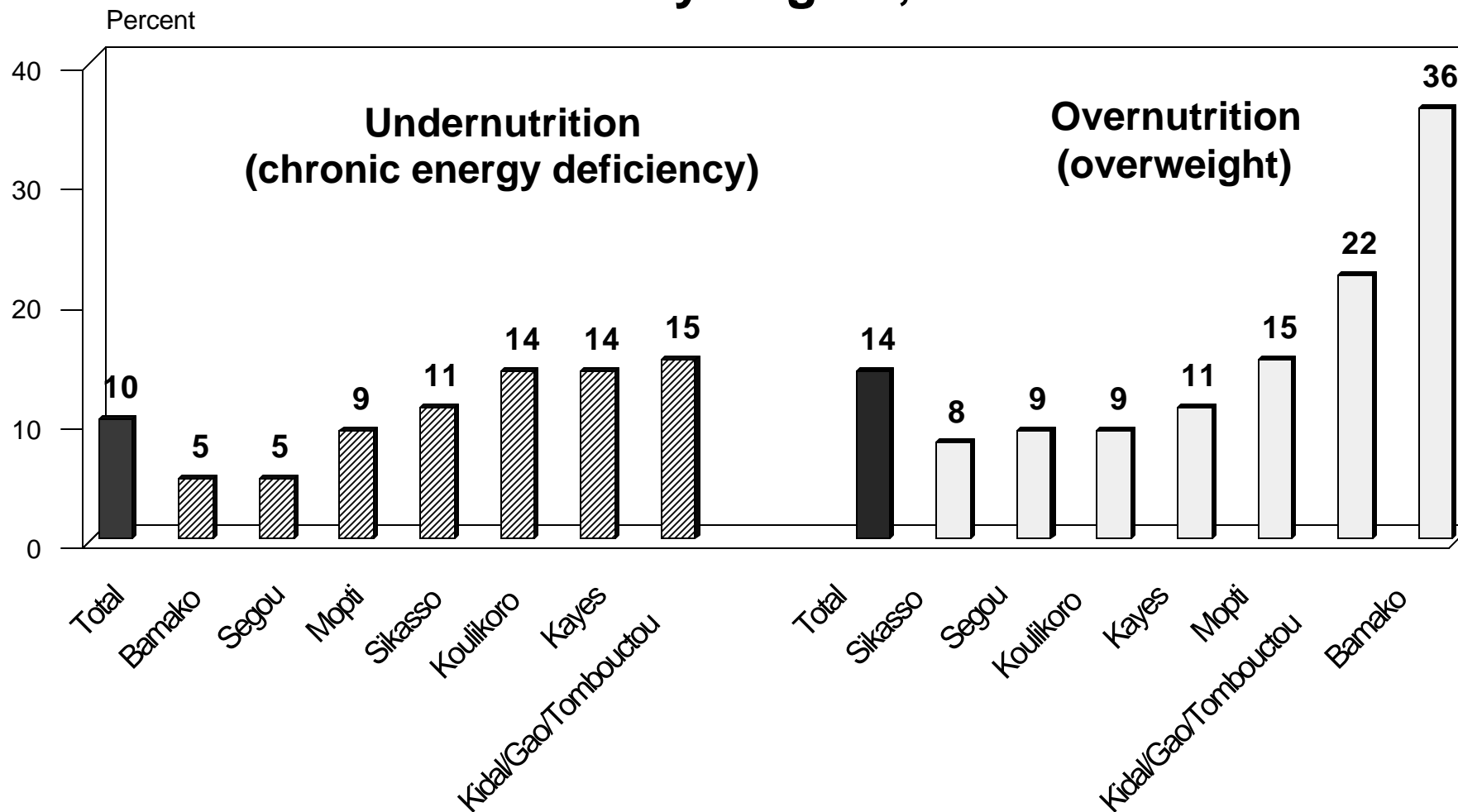
Malnutrition in women can be assessed by using the body mass index (BMI), which is defined as a woman's weight in kilograms divided by the square of her height in meters. Thus,  $BMI = \text{kg/m}^2$ . When the BMI is below the suggested cutoff point of 18.5, this indicates chronic energy deficiency or undernutrition for non-pregnant, non-lactating women. When the BMI is above 25, women are considered overweight.

- **Ten percent of mothers of children under age five in Mali are undernourished.**
- **The highest level of maternal undernutrition is in the joint Kidal/Goa/Tombouctou regions (15 percent). The lowest level is in Bamako (5 percent).**
- **Fourteen percent of mothers of children under five are overweight.**
- **The highest level of maternal overnutrition is in Bamako (36 percent). The lowest level is in the Sikasso region (8 percent).**



# Figure 30

## Malnutrition among Mothers of Children under Five Years by Region, Mali



Note: Maternal undernutrition is the percentage of mothers whose BMI (kg/m<sup>2</sup>) is less than 18.5. Maternal overnutrition is the percentage of mothers whose BMI is greater than 25.

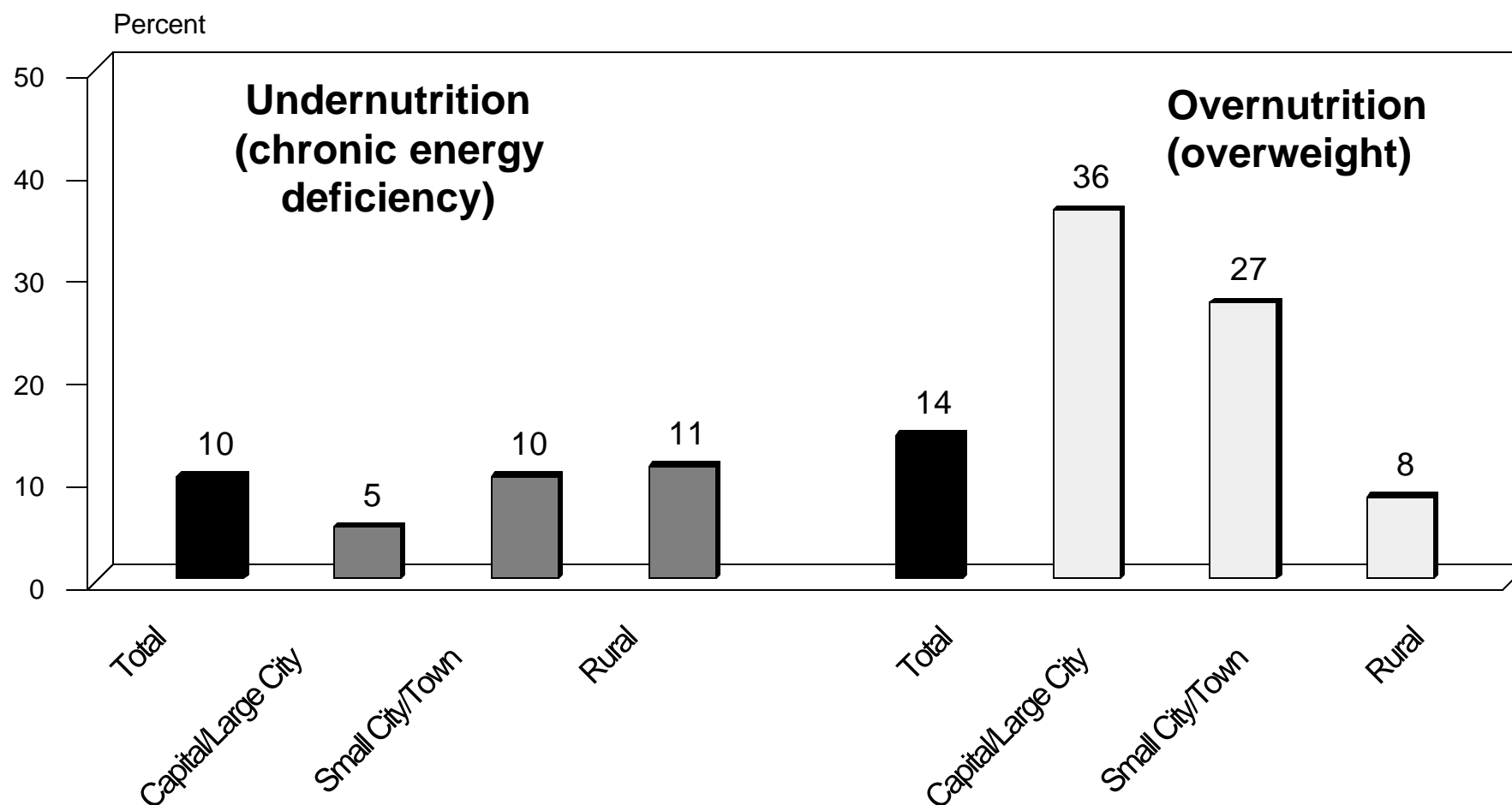
## **Figure 31: Malnutrition among Mothers of Children under Five Years by Residence, Mali**

In Mali,

- **The undernutrition rate (chronic energy deficiency) for mothers of children under five is 5 percent in the capital and other large cities, 10 percent in small cities and towns, and 11 percent in rural areas.**
- **The overnutrition rate (overweight) for mothers of children under five is lowest in rural areas (8 percent) and highest in the capital and other large cities (36 percent).**

# Figure 31

## Malnutrition among Mothers of Children under Five Years, by Residence, Mali



Note: Maternal undernutrition is the percentage of mothers whose BMI (kg/m<sup>2</sup>) is less than 18.5. Maternal overnutrition is the percentage of mothers whose BMI is greater than 25.

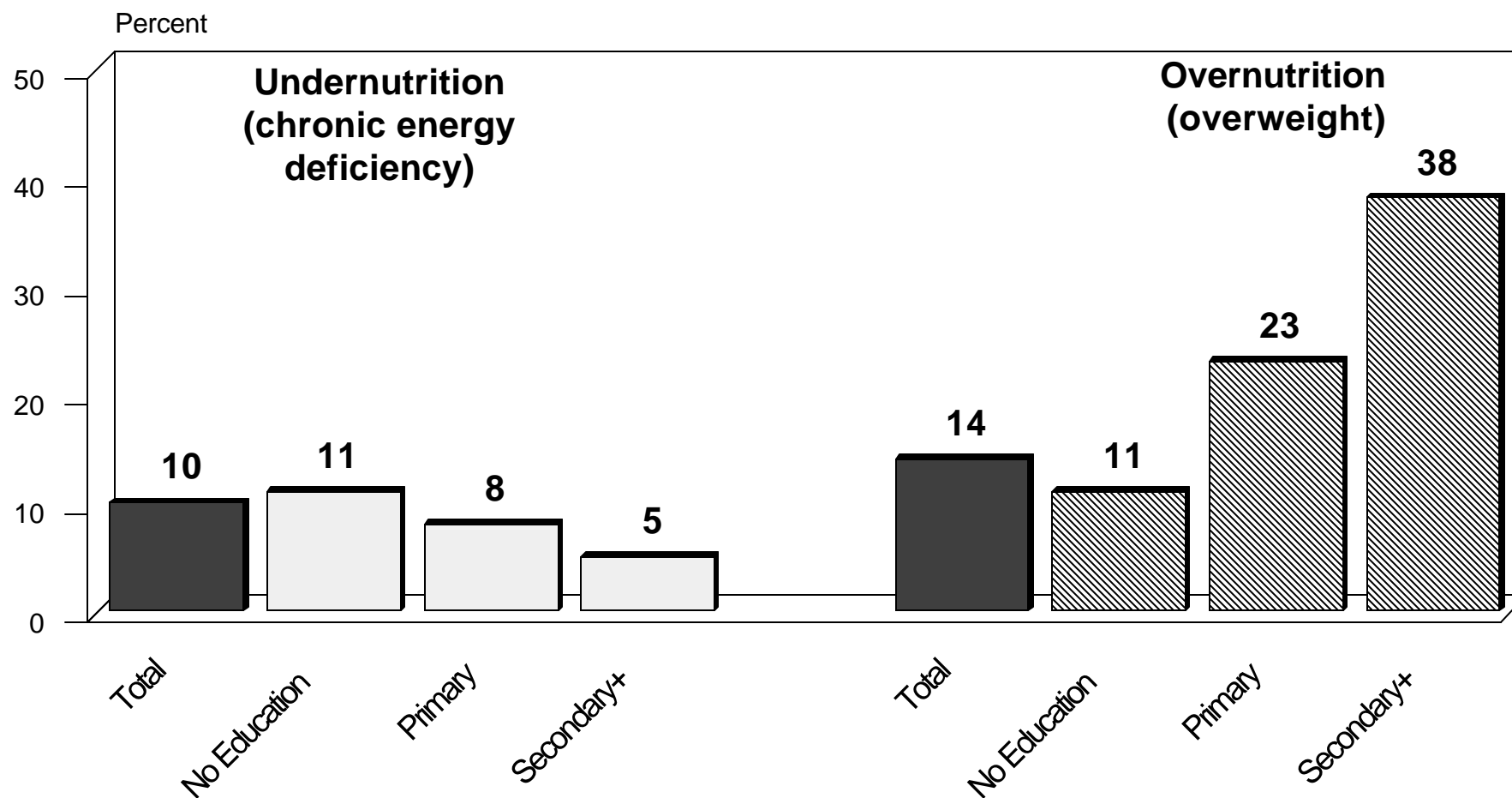
## **Figure 32: Malnutrition among Mothers of Children under Five Years by Education, Mali**

In Mali,

- **The rate of maternal undernutrition is highest among women with no education (11 percent) and lowest among those with at least a secondary school education (5 percent).**
- **The rate of maternal overnutrition is highest among women with at least a secondary school education (38 percent) and lowest among those with no education (11 percent).**

# Figure 32

## Malnutrition among Mothers of Children under Five Years, by Education, Mali



Note: Maternal undernutrition is the percentage of mothers whose BMI (kg/m<sup>2</sup>) is less than 18.5. Maternal overnutrition is the percentage of mothers whose BMI is greater than 25.

## **Figure 33: Malnutrition among Mothers of Children under Three Years, Mali Compared with Other Sub-Saharan Countries**

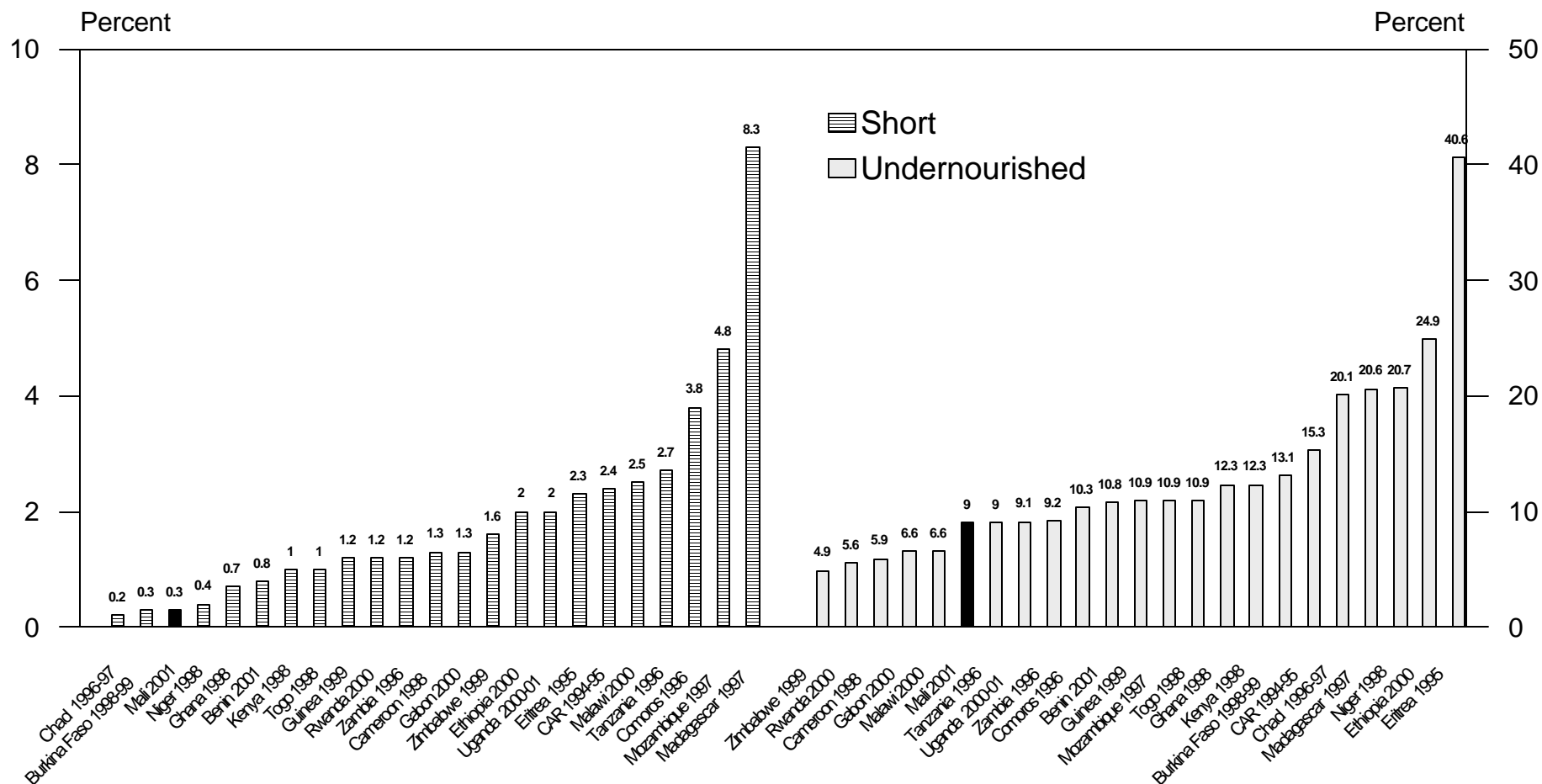
Malnutrition among mothers is likely to have a major impact on their ability to care for themselves and their children. Women less than 145 centimeters in height are considered too short. Mothers who are too short (a condition largely due to stunting during childhood and adolescence) may have difficulty during childbirth because of the small size of their pelvis. Evidence also suggests there is an association between maternal height and low birth weight. Underweight status in women assessed by using the body mass index is also presented. Pregnant women are not included in the malnourished analysis, due to weight considerations.

In Mali,

- **Less than 1 percent of mothers of children under three are too short (<145 cm).** This proportion is among the lowest of the sub-Saharan countries surveyed.
- **Nine percent of mothers of children under three are undernourished (BMI<18.5).** This is in the lower range of the sub-Saharan countries surveyed.

# Figure 33

## Malnutrition among Mothers of Children under Three Years, Mali Compared with Other Sub-Saharan Countries



Note: Short is the percentage of mothers under 145 cm; undernourished is the percentage of mothers whose BMI (kg/m<sup>2</sup>) is less than 18.5. Pregnant women and those who are less than two months postpartum are excluded from BMI calculation.

# Appendices



**Appendix 1**  
**Stunting, Wasting, Underweight, and Overweight Rates by Background Characteristics**  
**Mali 2001**

Background characteristic	Stunted	Wasted	Underweight	Overweight	Background characteristic	Stunted	Wasted	Underweight	Overweight
<b>Child's age in months</b>					<b>Region</b>				
0-5	5.4	4.9	2.9	15.8	Bamako	15.8	6.1	15.3	7.9
6-11	19.5	13.8	29.1	7.9	Goa/Kidal/ Tombouctou	39.5	15.8	36.2	7.0
12-17	38.6	22.1	47.6	3.8	Kayes	38.0	10.2	32.0	9.7
18-23	56.8	18.4	50.6	4.2	Koulikoro	35.3	11.0	32.4	4.5
24-29	44.5	10.3	41.2	4.0	Mopti	38.8	10.4	33.7	5.6
30-35	53.9	10.6	46.3	4.9	Ségou	39.9	14.5	36.5	9.2
36-47	47.9	6.4	33.2	7.2	Sikasso	47.4	9.5	40.7	6.7
48-59	41.4	6.6	29.9	6.8					
	p<0.001 n=9,406	p<0.001 n=9,407	p<0.001 n=9,409	p<0.001 n=9,408		p<0.001 n=9,406	p<0.001 n=9,410	p<0.001 n=9,407	p<0.001 n=9,409
<b>Gender of child</b>					<b>Urban-rural residence</b>				
Female	36.9	10.0	32.2	7.4	Capital or large city	15.8	6.1	15.3	7.9
Male	38.3	11.4	34.4	6.9	Small city or town	29.8	9.8	25.4	8.7
	NS n=9,407	p<0.028 n=9,409	p<0.024 n=9,407	NS n=9,408	Rural	42.1	11.6	37.2	6.8
						p<0.001 n=9,409	p<0.001 n=9,408	p<0.001 n=9,408	p<0.048 n=9,407
<b>Overall</b>	<b>37.6</b>	<b>10.7</b>	<b>33.3</b>	<b>7.2</b>	<b>Overall</b>	<b>37.6</b>	<b>10.7</b>	<b>33.3</b>	<b>7.2</b>

Note: Level of significance is determined using the chi-square test.

NS=Not significant at  $p \leq 0.05$

## **Appendix 2**

# **WHO/CDC/NCHS International Reference Population Compared with the Distribution of Malnutrition in Mali**

The assessment of nutritional status is based on the concept that in a well-nourished population, the distributions of children's height and weight, at a given age, will approximate a normal distribution. This means that about 68 percent of children will have a weight within one standard deviation of the mean for children of that age or height and a height within one standard deviation of the mean for children of that age. About 14 percent of children will be between one and two standard deviations above the mean; these children are considered relatively tall or overweight for their age or relatively overweight for their height. Another 14 percent will be between one and two standard deviations below the mean; these children are considered relatively short or underweight for their age or relatively thin for their height. Of the remainder, 2 percent will be very tall or obese for their age or obese for their height; that is, they are more than two standard deviations above the mean. Another 2 percent will fall more than two standard deviations below the mean and be considered moderately or severely malnourished. These children are very short (stunted), very underweight for their age, or very thin for their height (wasted). For comparative purposes, nutritional status has been determined using the International Reference Population defined by the United States National Center for Health Statistics (NCHS standard) as recommended by the World Health Organization and the Centers for Disease Control and Prevention.

Appendix 2 includes four curves: height-for-age, weight-for-height, and weight-for-age graphed against the normal curve. The height-for-age, weight-for-height, and weight-for-age curves are far to the left of the standard curve, indicating that there are a large number of malnourished children. The implication is that interventions are necessary to address widespread malnutrition in order to improve child health, which will result in a shift in the curves closer to the reference standard.

# Appendix 2

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