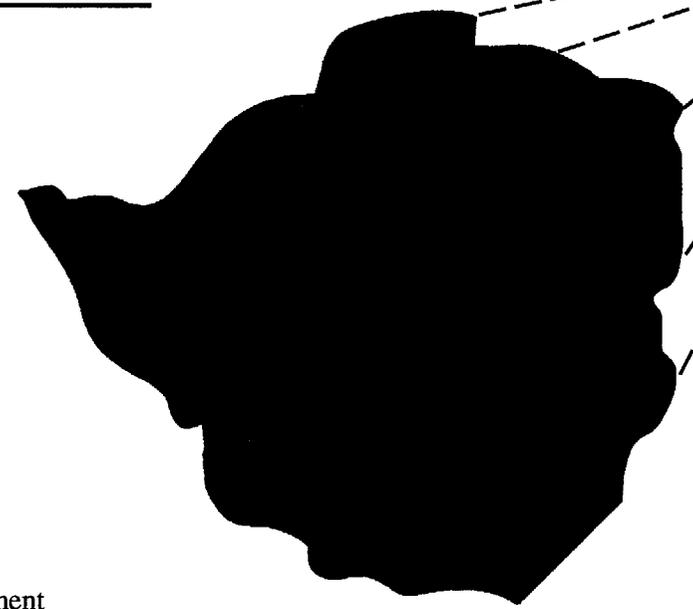


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Nutrition of Infants And Young Children In Zimbabwe, 1994



AFRICA NUTRITION CHARTBOOKS



U.S. Agency for International Development
AFR/SD/HRD and G/PHN/HN



Macro International Inc.



Food Security and Nutrition Monitoring Project

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PN-ACL-816

AFRICA NUTRITION CHARTBOOKS

NUTRITION OF INFANTS AND YOUNG CHILDREN IN ZIMBABWE

Findings from the 1994 Zimbabwe DHS Survey

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July 1996

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Introduction

Undernutrition¹ is one of the most important health and welfare problems among infants and young children in Zimbabwe. It is a result of both inadequate food intake and disease. Inadequate food intake is a consequence of insufficient food available at the household level and improper feeding practices. Infectious diseases, particularly diarrhoea, acute respiratory illness, malaria and measles, result from inadequate health care, poor environmental sanitation and insufficient water supplies. Both inadequate food intake and disease reflect underlying social and economic conditions.

Among the significant health and economic consequences of undernutrition, the most serious is an increased risk of death. Other adverse consequences include an increased risk of illness, lower cognitive development and poor pregnancy outcomes.

The Zimbabwe data analyzed here are from the 1994 Zimbabwe Demographic and Health Survey (ZDHS), a nationally representative survey of 5,984 households conducted by the Central Statistical Office of the Government of Zimbabwe, with technical assistance from Macro International and funding from the U.S. Agency for International Development. Fieldwork was conducted between July and November 1994. Of the 2,328 living children age 0-35 months that were part of the ZDHS, 2,086 are included in these analyses. Nutritional data collected on these children include height, weight, age, breastfeeding history, and feeding patterns. Information was also collected on diarrhoea, fever and cough in the two weeks prior to the survey and on relevant socio-demographic characteristics. For comparison purposes, data are presented from Demographic and Health Surveys conducted in other sub-Saharan countries.

An earlier nutrition chartbook was published in 1993 based on data from the 1988 ZDHS. Where applicable, findings from the 1994 ZDHS have been compared with those from the 1988 ZDHS. A minor difference between the first and second chartbooks is that the second chartbook presents anthropometric data for children 0 to 35 months, whereas the first presented anthropometric data for children 3 to 35 months. Comparisons in the text between 1988 and 1994 thus apply to the 3 to 35 month age-range. The comparison of diarrhoea rates is between children 1 to 24 months (1988) and 0 to 24 months (1994). The one-month difference in age range has no effect on the comparison of prevalence rates. Other slight differences in presentation between the two chartbooks result from modifications in the ZDHS survey design between 1988 and 1994.

¹ The technical definitions of *undernutrition* as defined by the National Center for Health Statistics (NCHS), the Centers for Disease Control (CDC), and the World Health Organization (WHO) are presented in Appendix 2.

Figure 1: Undernutrition among Children under 3 Years, Zimbabwe

In Zimbabwe:

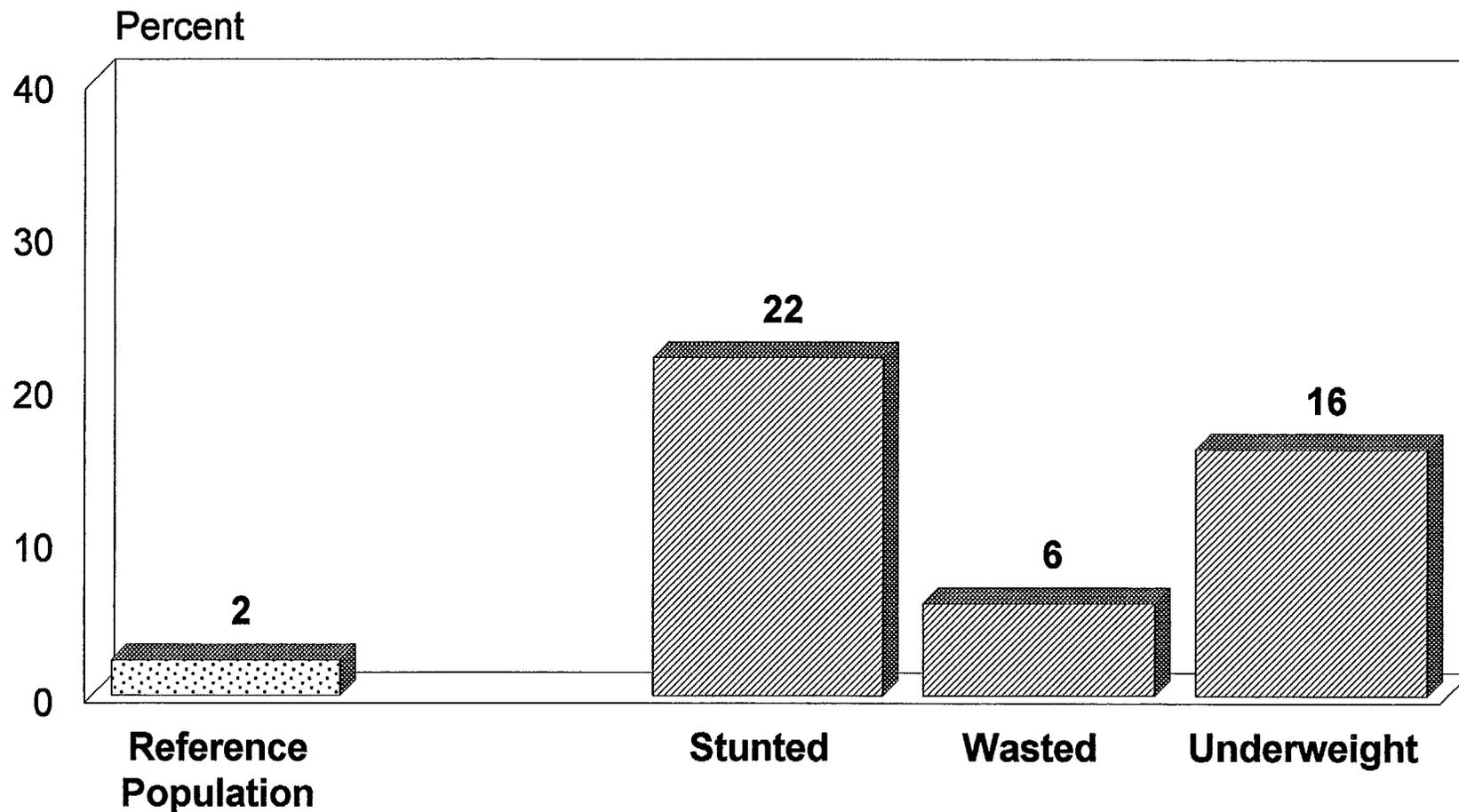
- **Twenty-two percent of children aged 0 to 35 months are chronically undernourished.** In other words, they are too short for their age or *stunted*.¹ The proportion of children who are stunted is 11 times the level expected in a healthy, well-nourished population. The proportion of children aged 3 to 35 months who are stunted has decreased by 20 percent since the 1988 ZDHS.
- **Acute undernutrition**, manifested by *wasting*,² results in a child being too thin for his or her height. Wasting affects 6 percent of children, which is three times the level expected in a healthy, well-nourished population. The proportion of children aged 3 to 35 months who are wasted is 6 times the level found in the 1988 ZDHS.
- **Sixteen percent of children are *underweight***³ for their age. This is 8 times the level expected in a healthy, well-nourished population. The proportion of underweight children aged 3 to 35 months has increased by about a third since the 1988 ZDHS.

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

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

³ 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 undernutrition, or a combination of both.

Figure 1
Undernutrition among Children under 3 Years, Zimbabwe



Note: *Stunted* reflects chronic undernutrition; *wasted* reflects acute undernutrition; *underweight* reflects chronic or acute undernutrition, or a combination of both.

Source: ZDHS 1994

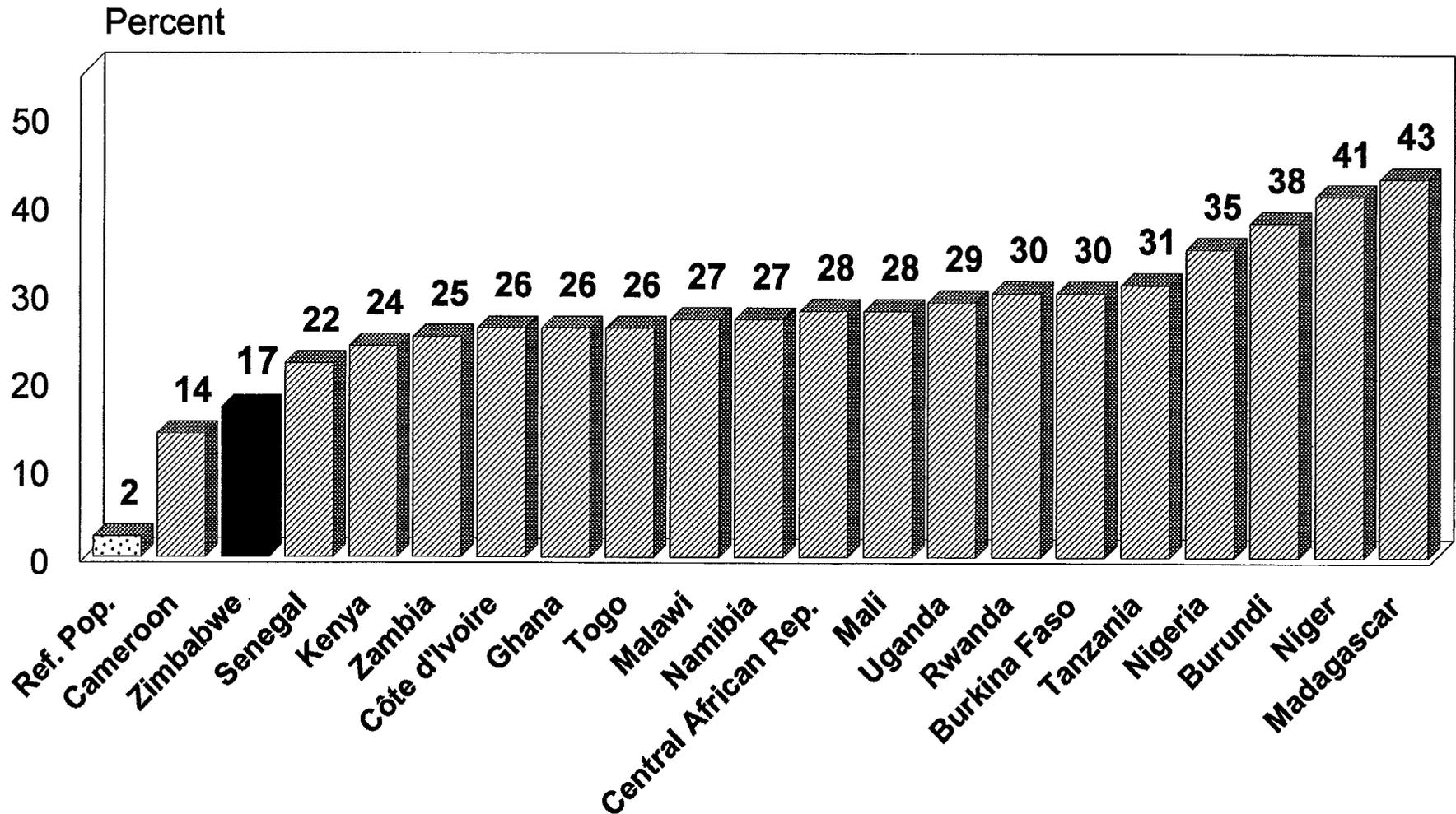
Figure 2: Underweight among Children Age 3 to 35 Months in Zimbabwe Compared with Other Sub-Saharan Countries

Among the sub-Saharan countries surveyed:

- The percentage of children age 3 to 35 months who are underweight ranges from 14 to 43 percent. **At 17 percent, the proportion of underweight children in Zimbabwe is the second lowest among all of the sub-Saharan countries surveyed.** This represents an increase of 4 percentage points since the 1988 ZDHS.

Figure 2

Underweight among Children Age 3 to 35 Months in Zimbabwe Compared with Other Sub-Saharan Countries



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

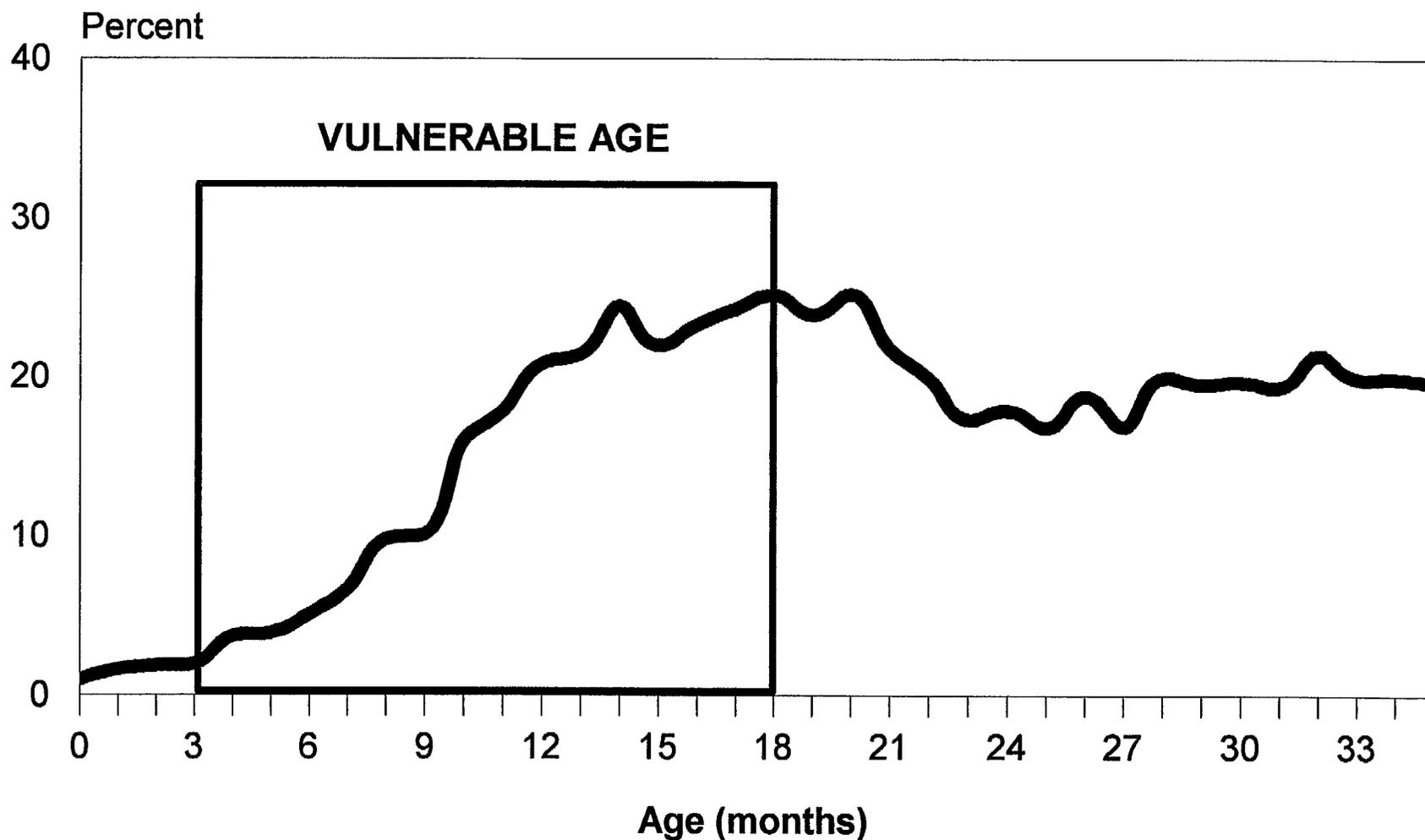
Source: DHS Surveys 1986-1995

Figure 3: Underweight by Age, Zimbabwe

In Zimbabwe, the time between 3 months and 18 months of age is a vulnerable period:

- **The proportion of children underweight increases rapidly from 3 months to 18 months of age, at which time it peaks at about 25 percent.** It decreases to around 20 percent by the end of the second year and remains at this level through the third year of life. The overall age pattern is similar to that observed in 1988, but the proportion of children underweight has increased.

Figure 3
Underweight by Age, Zimbabwe



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

Source: ZDHS 1994

Figure 4: Feeding Practices for Infants under 4 Months, Zimbabwe

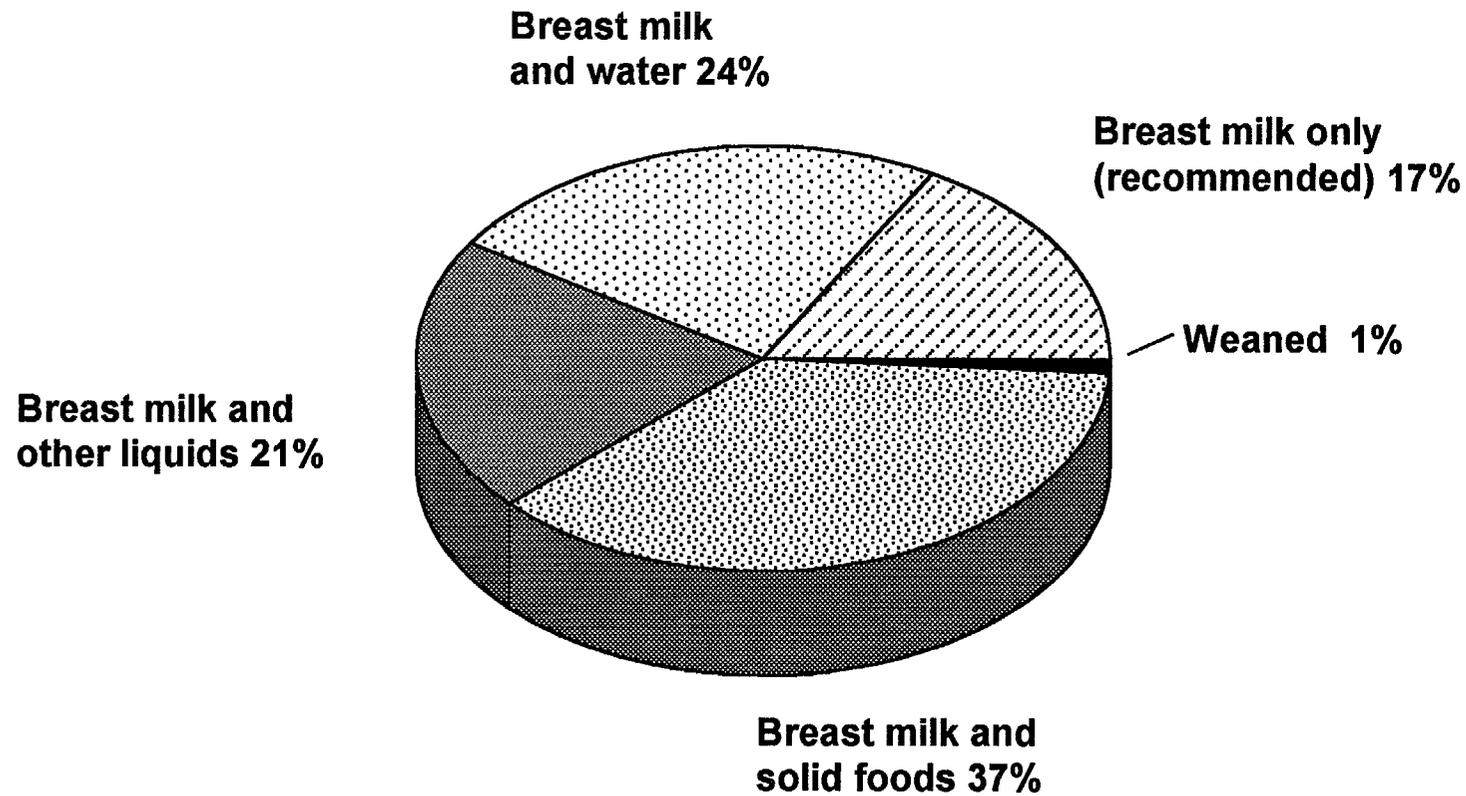
Improper feeding practices, in addition to infectious disease, are important determinants of undernutrition. The World Health Organization (WHO) recommends that *all infants be exclusively breastfed from birth until about 6 months of age.*¹ In other words, infants should be fed only breast milk during the first months of their lives.

In Zimbabwe, the introduction of liquids, such as water, sugar water, juice, formula, and solid foods, takes place far earlier than the recommended age of about 6 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 and thus puts them at greater risk of diarrhoeal disease.

- **In Zimbabwe, 17 percent of children under the age of 4 months are exclusively breastfed, as is recommended by WHO. This represents an increase in exclusive breastfeeding since the 1988 ZDHS, which found that only 12 percent of mothers followed the WHO recommendation.**
- **Nearly 60 percent of infants under 4 months old are given some form of supplements other than water, which is not recommended. The majority of these infants receive solid or semi-solid foods.**

¹ World Health Organization, Forty-seventh World Health Assembly (WHA 47.5), May 9, 1994.

Figure 4
Feeding Practices for Infants under 4 Months, Zimbabwe



Note: WHO recommends that all infants be breastfed exclusively until they are about 6 months old.

Source: ZDHS 1994

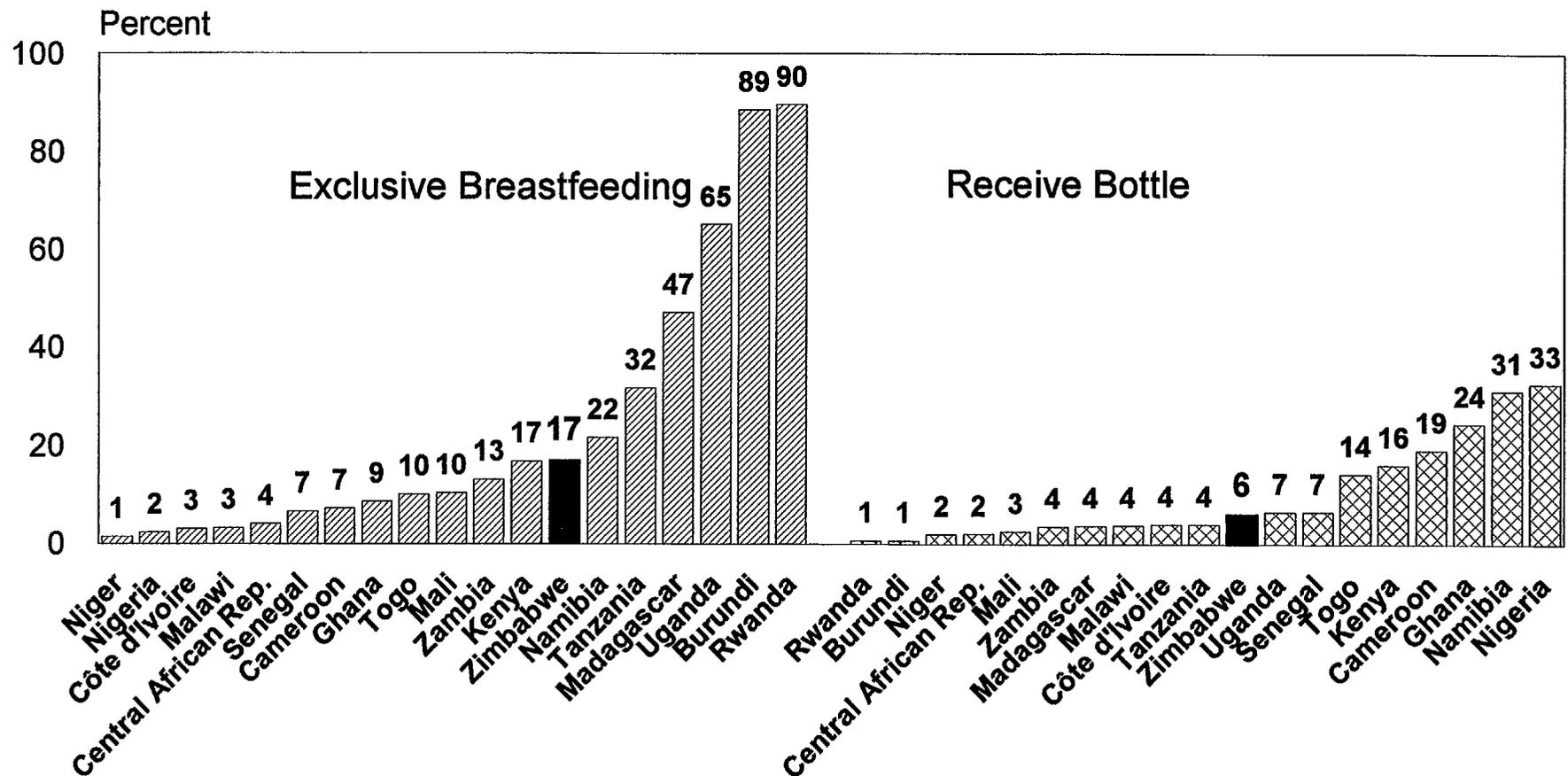
Figure 5: Infants under 4 Months Who are Exclusively Breastfed and Those Who Receive a Supplemental Bottle in Zimbabwe Compared with Other Sub-Saharan Countries

The failure to exclusively breastfeed young infants, the introduction of liquids and solid foods at too early an age and the use of bottles, all increase the risks of diarrhoea, other infectious diseases and mortality in Africa.

- In most of the sub-Saharan countries surveyed, relatively few mothers of infants under 4 months follow the recommended practice of breastfeeding exclusively. **Less than one-fifth of mothers in Zimbabwe breastfeed their young infants exclusively.** This places them in the middle range of sub-Saharan countries. Exclusive breastfeeding has increased by 42 percent since the 1988 ZDHS, when 12 percent of children were exclusively breastfed.
- **Bottle feeding, which is not recommended by WHO, is used by only 6 percent of mothers of infants under 4 months in Zimbabwe, representing an increase since 1988.**

Figure 5

Infants under 4 Months Who Are Exclusively Breastfed and Those Who Receive a Supplemental Bottle in Zimbabwe Compared with Other Sub-Saharan Countries



Note: Information on feeding practices is based on the 24 hours preceding the survey. WHO recommends that all infants should receive nothing but breast milk until about 6 months of age.

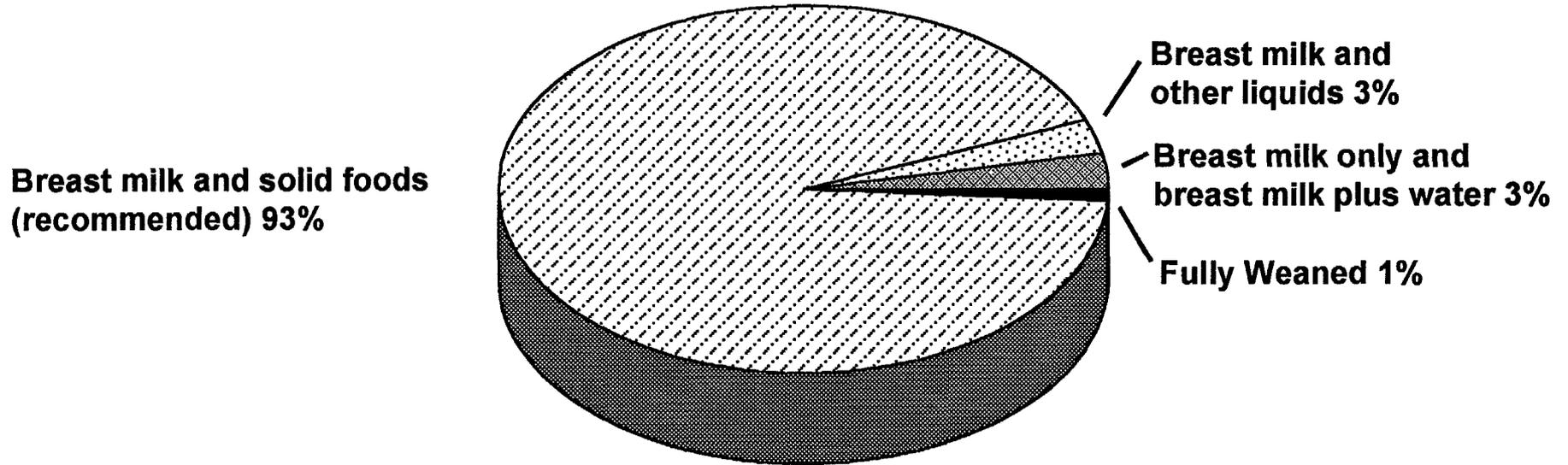
Source: DHS Surveys 1986-1995

Figure 6: Feeding Practices for Infants Age 6 to 9 Months, Zimbabwe

The WHO recommends that solid foods be introduced to infants around the age of 6 months because breast milk alone is no longer sufficient to maintain a child's optimal growth. Thus, *all infants over 6 months of age should be receiving solid foods* along with breast milk.

- **In Zimbabwe, 93 percent of infants age 6 to 9 months are fed solid foods in addition to breast milk.** In other words, a majority of infants between the ages of 6 and 9 months are fed **according to the recommended practice**. The proportion of mothers who feed their infants solid foods in addition to breast milk is virtually unchanged since the 1988 ZDHS.
- **Only 7 percent of infants age 6 to 9 months are not fed solid foods in addition to breast milk; 1 percent are fully weaned from the breast.**

Figure 6
Feeding Practices for Infants Age 6 to 9 Months, Zimbabwe



Note: WHO recommends that by the age of 6 months all infants should receive solid foods in addition to breast milk.

Source: ZDHS 1994

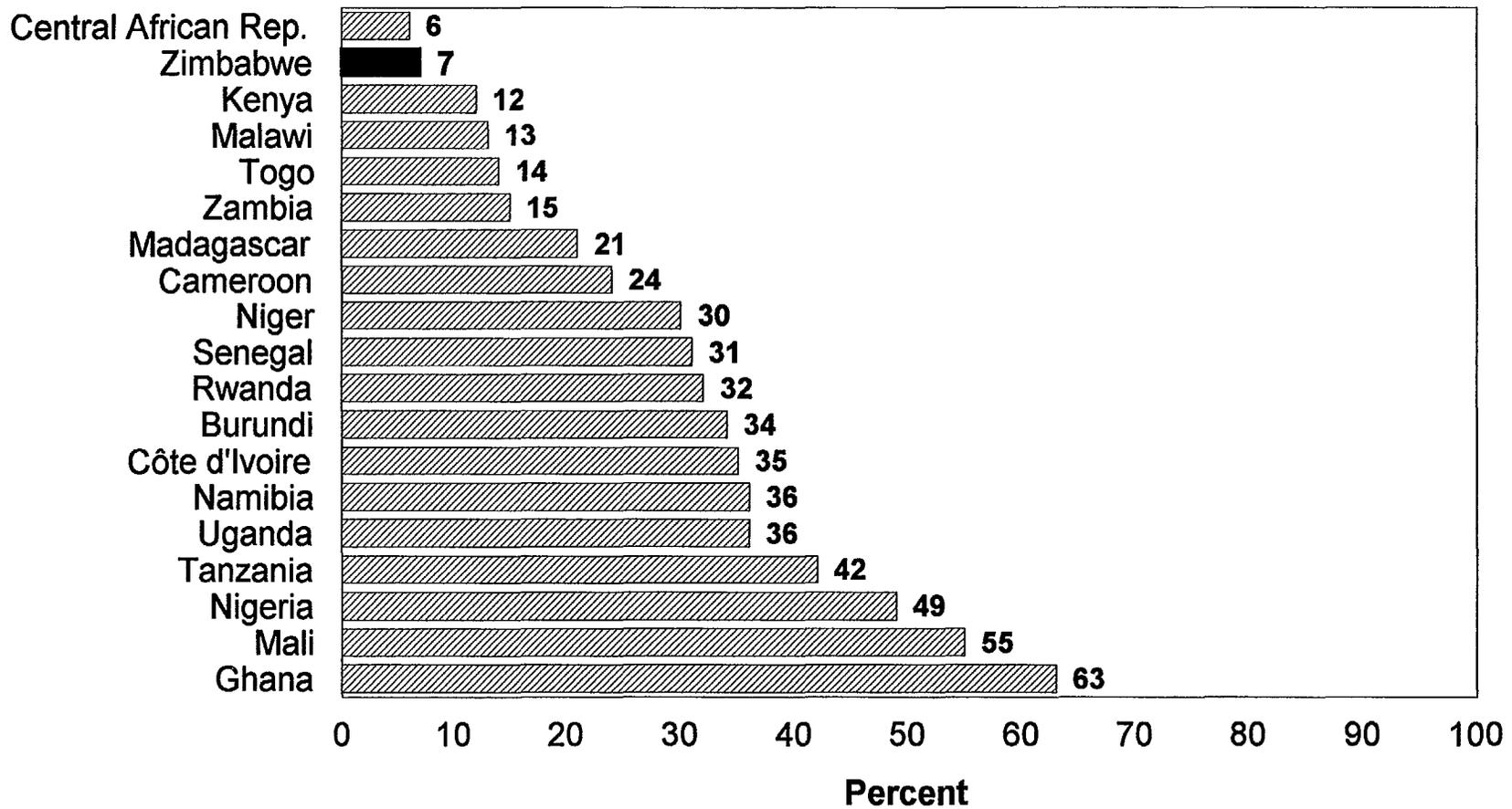
Figure 7: Infants Age 6 to 9 Months Not Receiving Food in Addition to Breast Milk in Zimbabwe Compared with Other Sub-Saharan Countries

In Zimbabwe:

- **Only 7 percent of infants age 6 to 9 months do not receive solid food in addition to breast milk. This is in the second lowest among the countries surveyed, indicating a very high degree of compliance with WHO recommendations.**

Figure 7

Infants Age 6 to 9 Months Not Receiving Food in Addition to Breast Milk in Zimbabwe Compared with Other Sub-Saharan Countries



Note: WHO recommends that by the age of 6 months all infants should receive solid foods and liquids in addition to breast milk.

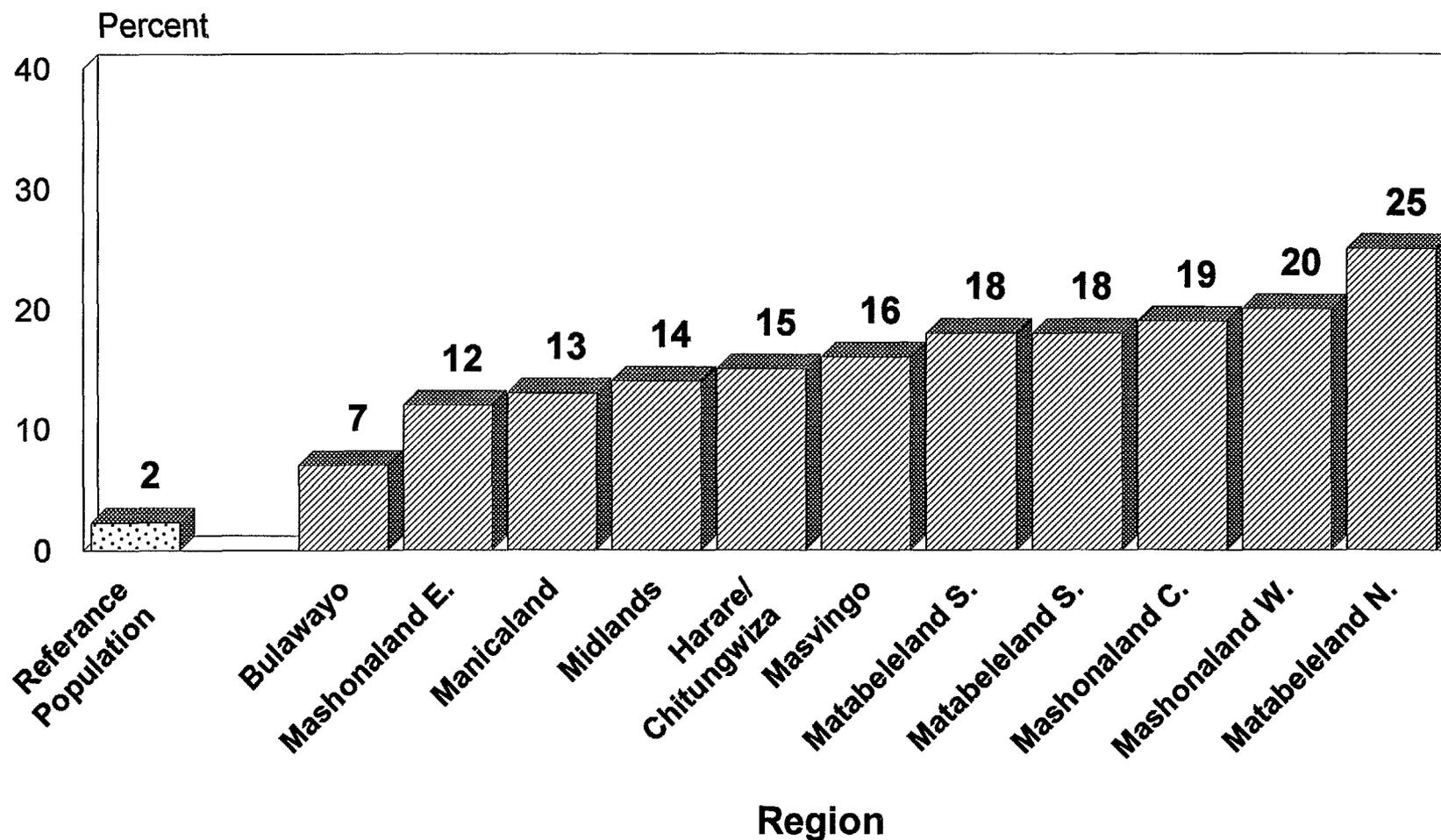
Source: DHS Surveys 1986-1995

Figure 8: Underweight among Children under 3 Years by Region, Zimbabwe

In Zimbabwe:

- **Underweight occurs in one-quarter of children living in Matabeleland North and in one-fifth of the children living in Mashonaland West.**
- **Children living in Matabeleland North are more than three times as likely to be underweight as those living in Bulawayo.**

Figure 8
Underweight among Children under 3 Years
by Region, Zimbabwe



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

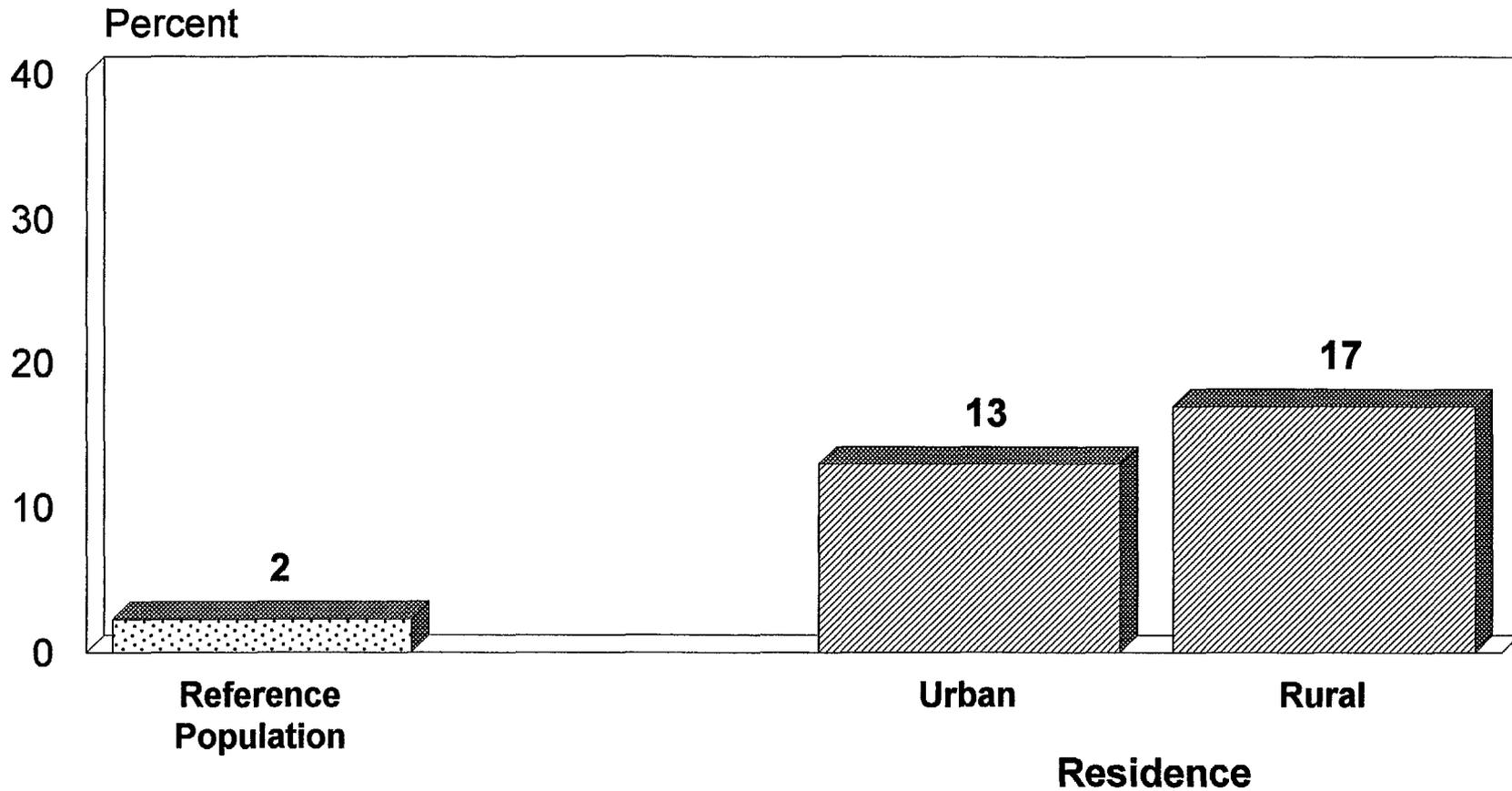
Source: ZDHS 1994

Figure 9: Underweight among Children under 3 Years by Residence, Zimbabwe

In Zimbabwe:

- **In rural areas, where over two-thirds of the population lives, 17 percent of children under 3 years are underweight.**
- **Urban children are less likely than their rural counterparts to be underweight: 13 percent of urban children under 3 years are underweight.**

Figure 9
**Underweight among Children under 3 Years
by Residence, Zimbabwe**



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

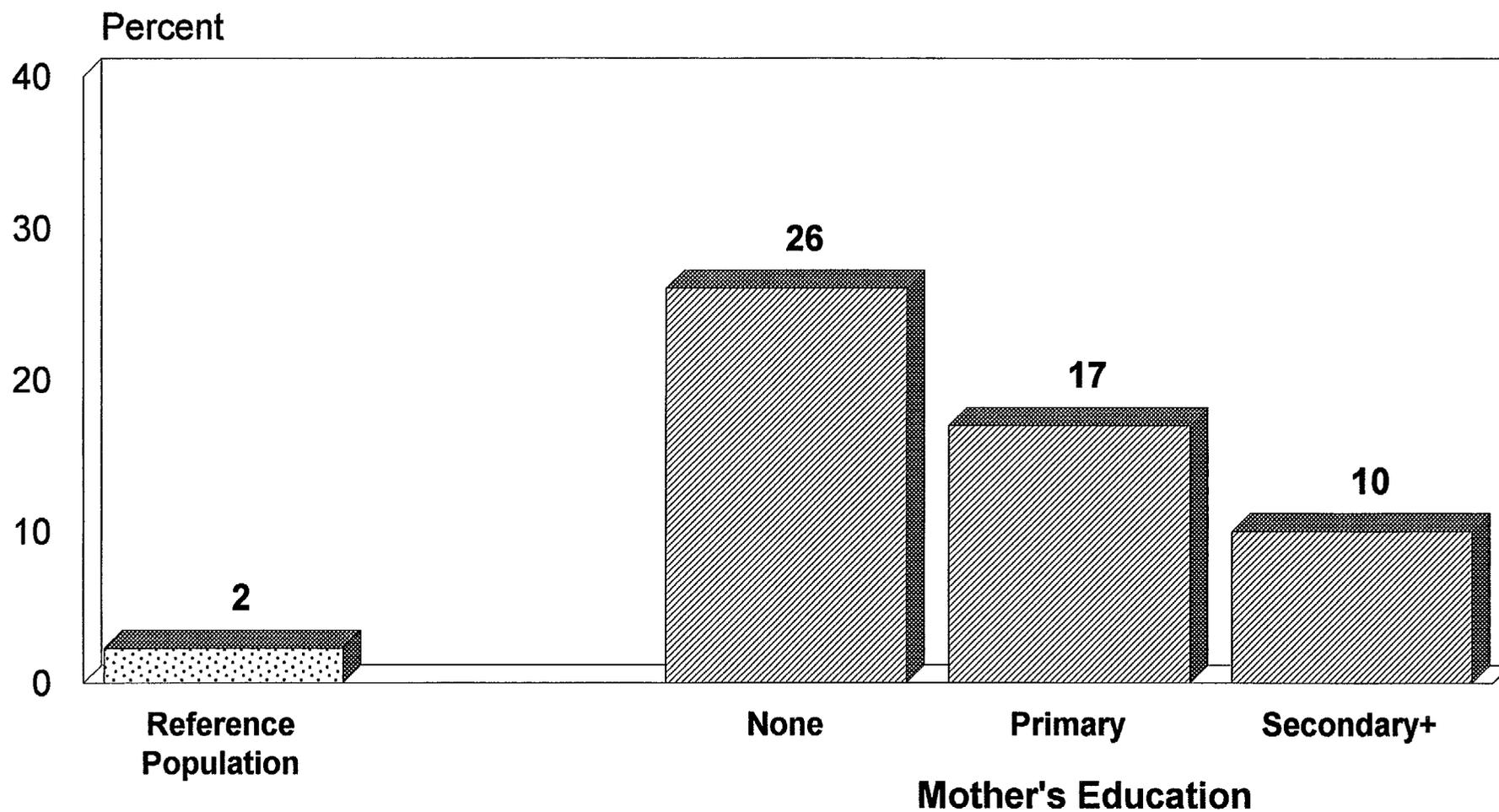
Source: ZDHS 1994

Figure 10: Underweight among Children under 3 Years by Mother's Education, Zimbabwe

Maternal education, which is related to household wealth, is a determinant of good child-care knowledge and practices. In Zimbabwe, only 13 percent of mothers with children under 3 years of age have never attended school, while over one-third have secondary or higher education. Maternal education varies widely across regions, and there are large differences between urban and rural areas. In urban areas, about 4 percent of mothers have never been to school and about 66 percent have gone to secondary school. In rural areas, 16 percent of mothers have not been to school, while 26 percent have been to secondary school.

- **Undernutrition is about two and a half times higher among children of mothers with no education, and almost twice as high among children of mothers with only primary school education, compared to children of mothers with secondary or higher education.**
- **A surprisingly high proportion (10 percent) of children of mothers with secondary or higher education are underweight. This is five times the level in the reference population.**

Figure 10
**Underweight among Children under 3 Years by
Mother's Education, Zimbabwe**



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

Source: ZDHS 1994

Figure 11: Underweight among Children under 3 Years by Source of Drinking Water, Zimbabwe

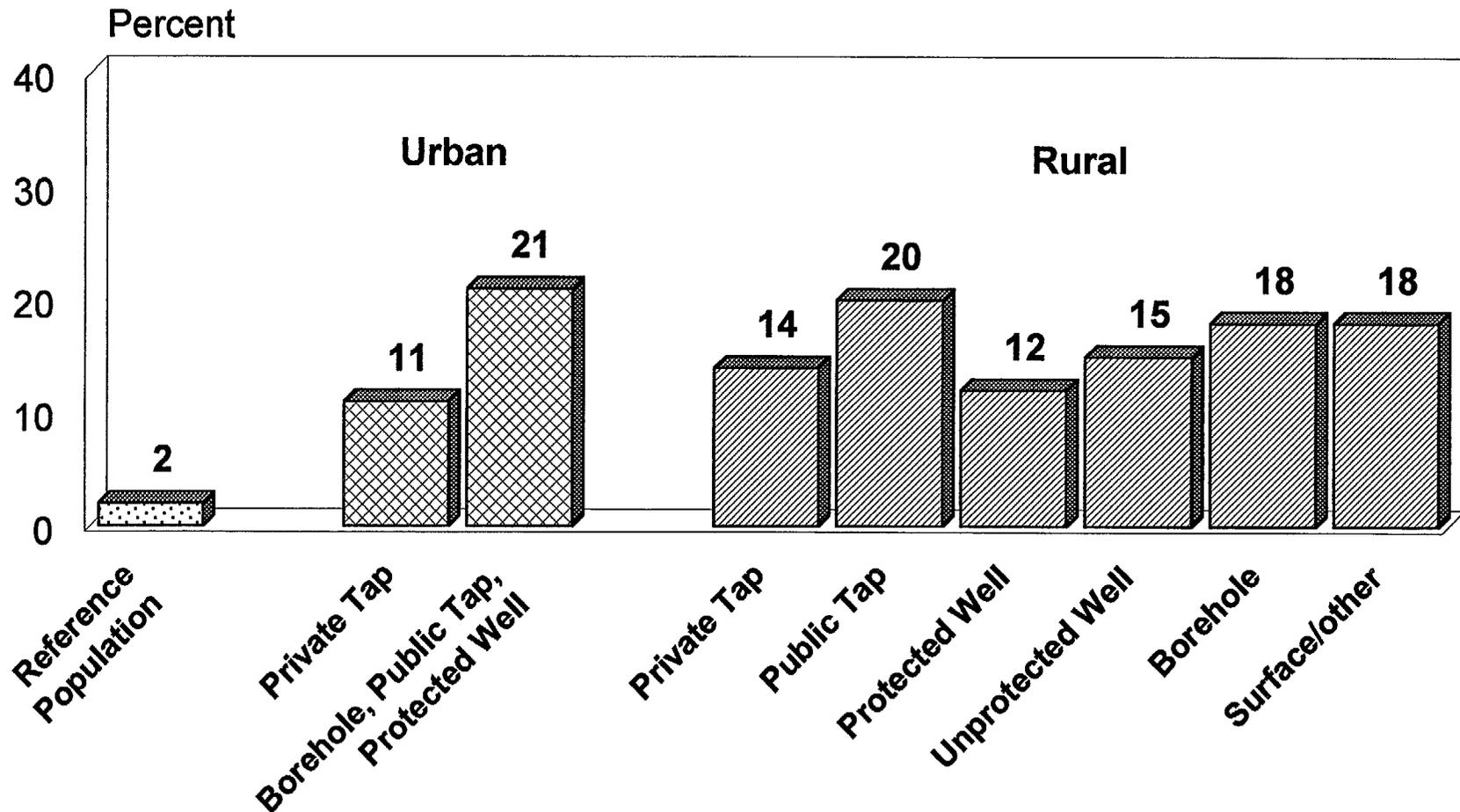
A household's source of drinking water is associated with child nutritional status directly, through its impact on hygiene and the risk of diarrhoeal disease, and indirectly, as a measure of wealth and access to water. Without an adequate supply of good quality water, a household's personal, domestic and food hygiene are compromised and the risk of contamination (and thus diarrhoeal diseases) increases. Poor households are likely to have an insufficient supply of water and to obtain drinking water from contaminated sources, such as surface water.

In Zimbabwe, the type of drinking water available to households varies by residence. In urban areas, 93 percent of households use private taps, and the remainder use a borehole, public tap or protected well. In contrast, among rural households almost one-half (42 percent) obtain drinking water from a borehole, about 17 percent use unprotected wells, 13 percent use a public tap, and most of the remaining households use open water sources. Only 4 percent of rural residents obtain drinking water from a private tap. Among households with children under 3 years of age, the proportions are similar.

- **In urban areas**, among the small percentage of households where the source of drinking water is not a private tap, underweight among young children is twice as high as it is among children from the majority of households where private taps are the norm.
- **In rural areas**, underweight among children does not vary widely by source of drinking water; however, children from homes using a protected well are only 60 percent as likely to be undernourished as children from homes using a public tap. Rural residents who use a protected well are relatively wealthy compared with other rural residents, and this finding may reflect the impact of wealth on nutritional status.

Figure 11

Underweight among Children under 3 Years by Source of Drinking Water, Zimbabwe



Note: *Underweight* reflects chronic or acute undernutrition, or a combination of both

Source: ZDHS 1994

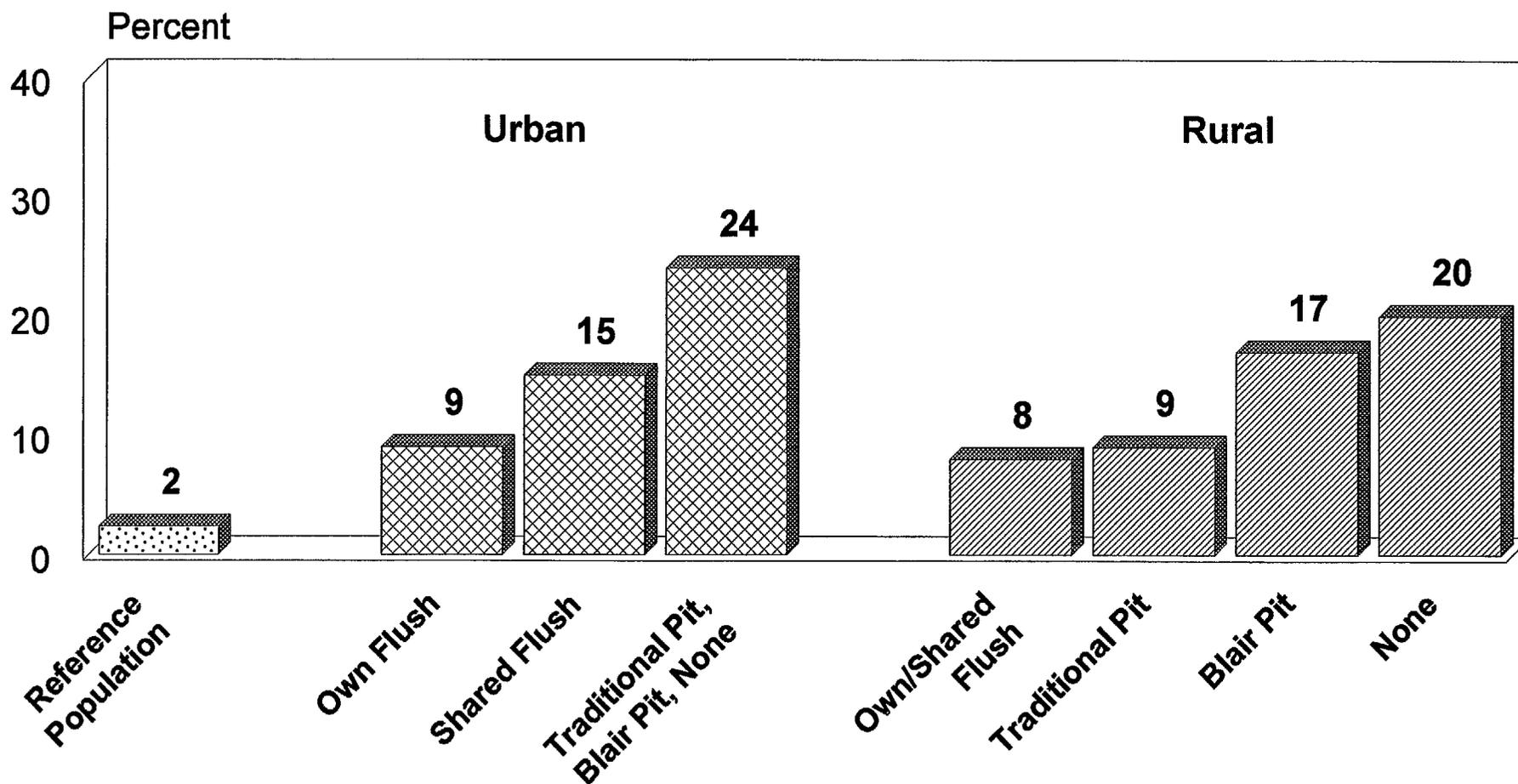
Figure 12: Underweight among Children under 3 Years by Type of Toilet, Zimbabwe

The type of toilet used by a household is an indicator of household wealth and a determinant of environmental sanitation. Poor households are less likely to have sanitary toilet facilities. Poor sanitation results in increased risk of diarrhoeal disease, which contributes to undernutrition. In Zimbabwe, the type of toilet used differs greatly by area of residence. In urban areas, two-thirds of all households use private flush toilets and more than one-fourth use a shared flush toilet. In rural areas, half of all households have no toilet facility, almost a third use a Blair¹ pit latrine, 17 percent use a traditional pit latrine and less than 3 percent use flush toilets.

- **In urban areas, children from households using pit latrines or having no toilet facilities are almost three times as likely to be underweight as children from households with private flush toilets. Children from households using shared toilet facilities are also more likely to be underweight than children from households with private flush toilets.**
- **In rural areas, children from households using Blair latrines or with no toilet facilities are approximately two times as likely to be underweight as children from households using traditional pit latrines or flush toilets. This finding suggests that Blair latrines are not having their intended beneficial impact on child nutrition and health.**

¹ Ventilated, improved pit latrine.

Figure 12
Underweight among Children under 3 Years by
Type of Toilet, Zimbabwe



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

Source: ZDHS 1994

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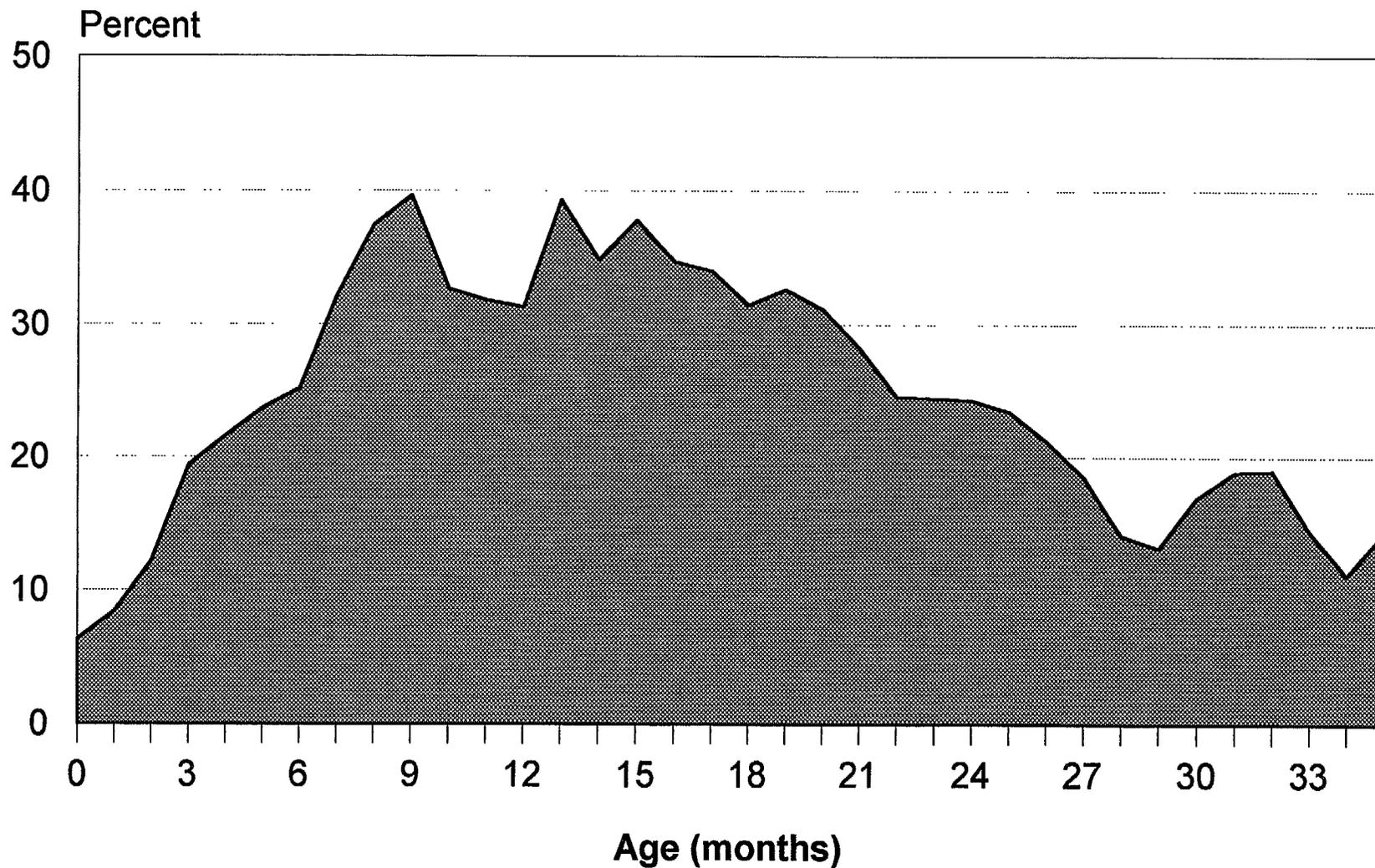
Figure 13: Age-related Pattern of Diarrhoea among Children under 3 Years, Zimbabwe

In Zimbabwe:

- **The prevalence of diarrhoea increases rapidly during infancy until it peaks at age 9 months, when nearly 40 percent of children are reported to have had diarrhoea during the preceding two weeks. The prevalence of diarrhoea remains high through 15 months of age, after which it declines gradually during the remainder of the second year and through the third year of life.**

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

Figure 13
**Age-Related Pattern of Diarrhoea among
Children under 3 Years, Zimbabwe**



Source: ZDHS 1994

Figure 14: Prevalence of Diarrhoea, Fever, and Cough among Children Age 0 to 24 Months¹ in Zimbabwe Compared with Other Sub-Saharan Countries

Diarrhoea, fever, and cough are common infectious diseases that may diminish a young child's nutritional status by decreasing food intake or absorption. While a single disease episode may affect short-term, or acute, nutritional status, growth will catch up with adequate food intake. After repeated episodes of disease, however, a child's growth cannot catch up sufficiently and long-term, or chronic, undernutrition results.

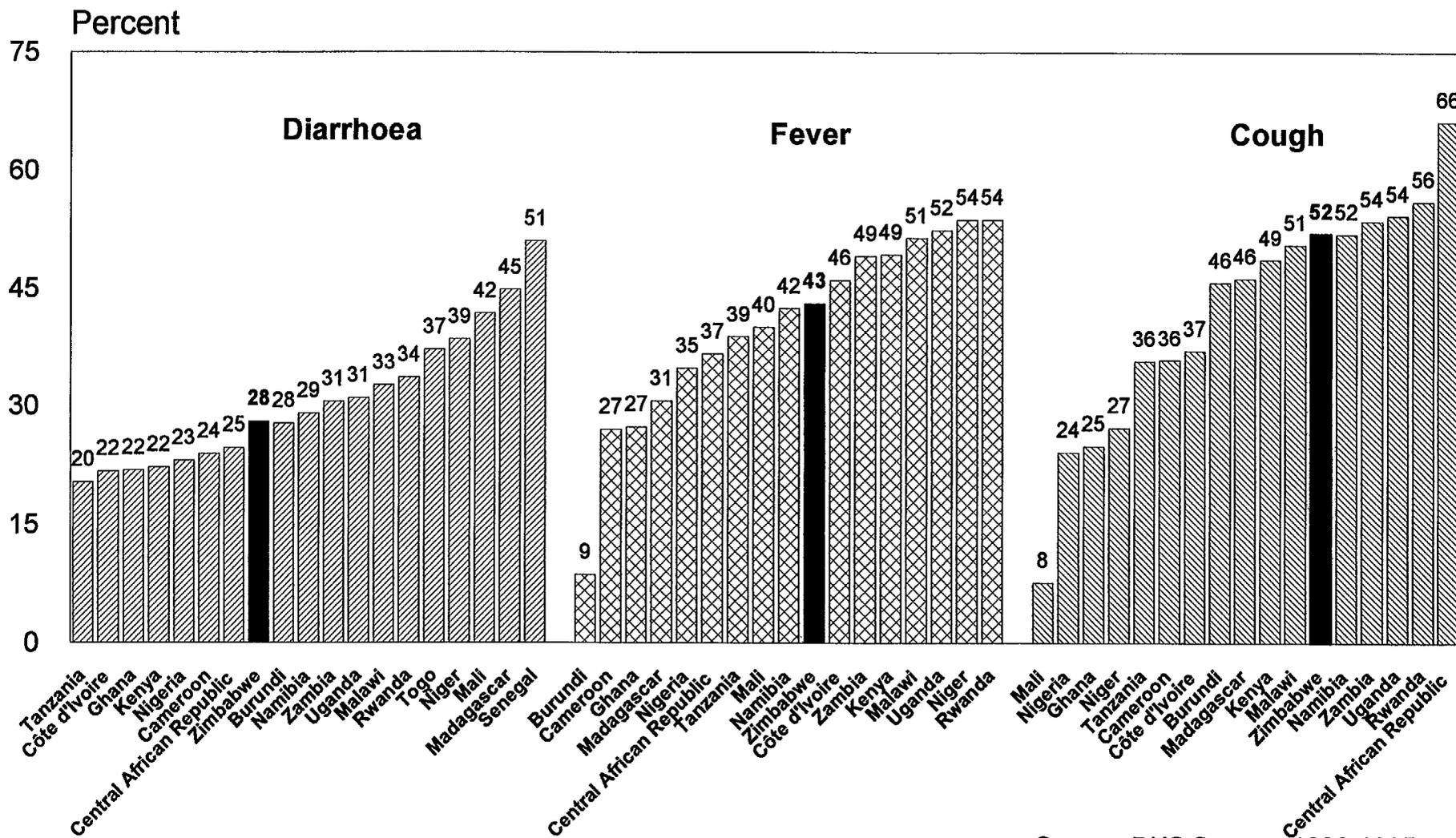
- **About 28 percent of Zimbabwe children under 24 months suffered from diarrhoea during the two weeks preceding the survey. This level is in the middle range for the sub-Saharan countries surveyed.² The prevalence of children with diarrhoea is similar to the rate found by the 1988 ZDHS.**
- **About 43 percent of Zimbabwe children reportedly had a fever during the two weeks prior to the survey. This is in the middle range of the sub-Saharan countries surveyed.**
- **Over half of the mothers reported their child had a cough in the preceding two weeks. This level falls in the upper middle range of the sub-Saharan countries surveyed.**

¹ Data are presented only for children under 2 years because this age group is the most vulnerable to diarrhoeal disease.

² Survey data on the prevalence of diarrhoea in different countries may not be strictly comparable because mothers' perceptions of diarrhoea may differ by country. Additionally, the prevalence of diarrhoea, fever, and respiratory illness is influenced by seasonal patterns and thus will vary depending on the season the fieldwork is conducted.

Figure 14

Prevalence of Diarrhoea, Fever, and Cough among Children Age 0 to 24 Months in Zimbabwe Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1986-1995

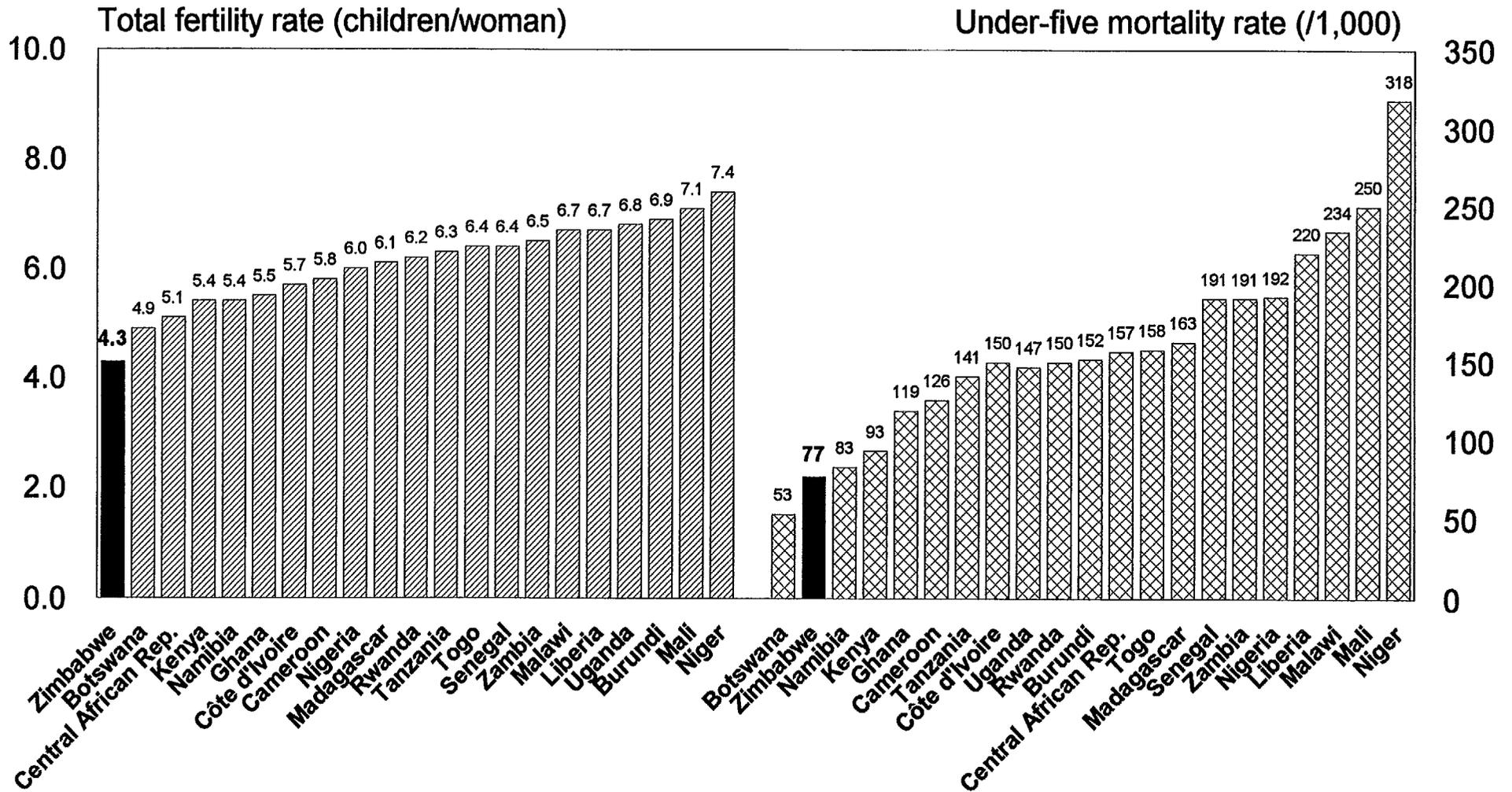
Figure 15: Fertility and Child Mortality in Zimbabwe Compared with Other Sub-Saharan Countries

High fertility rates, especially when accompanied by short intervals between births, 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 women's health, thus increasing the chances that a mother may not be able to breastfeed or care for her children adequately. Young children, who are more vulnerable to undernutrition and disease, are more likely to die.

- **At current fertility levels, each woman in Zimbabwe will have an average of 4.3 children by the end of her childbearing years (this is the total fertility rate for women age 15 to 49 years). This rate is the lowest among the sub-Saharan countries surveyed and represents a substantial decrease in fertility of almost one child since the 1988 ZDHS**
- **Under-five mortality is low in Zimbabwe compared with other sub-Saharan countries. At current mortality levels, less than 10 percent of children born will die before their fifth birthday. Zimbabwe's under-five mortality rate of 77 deaths per 1,000 births is the second lowest among all the sub-Saharan countries surveyed. The under-five mortality rate is similar to the rate found by the 1988 ZDHS.**

Figure 15

Fertility and Child Mortality in Zimbabwe Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1986-1995

Figure 16: Survival and Nutritional Status of Children, Zimbabwe

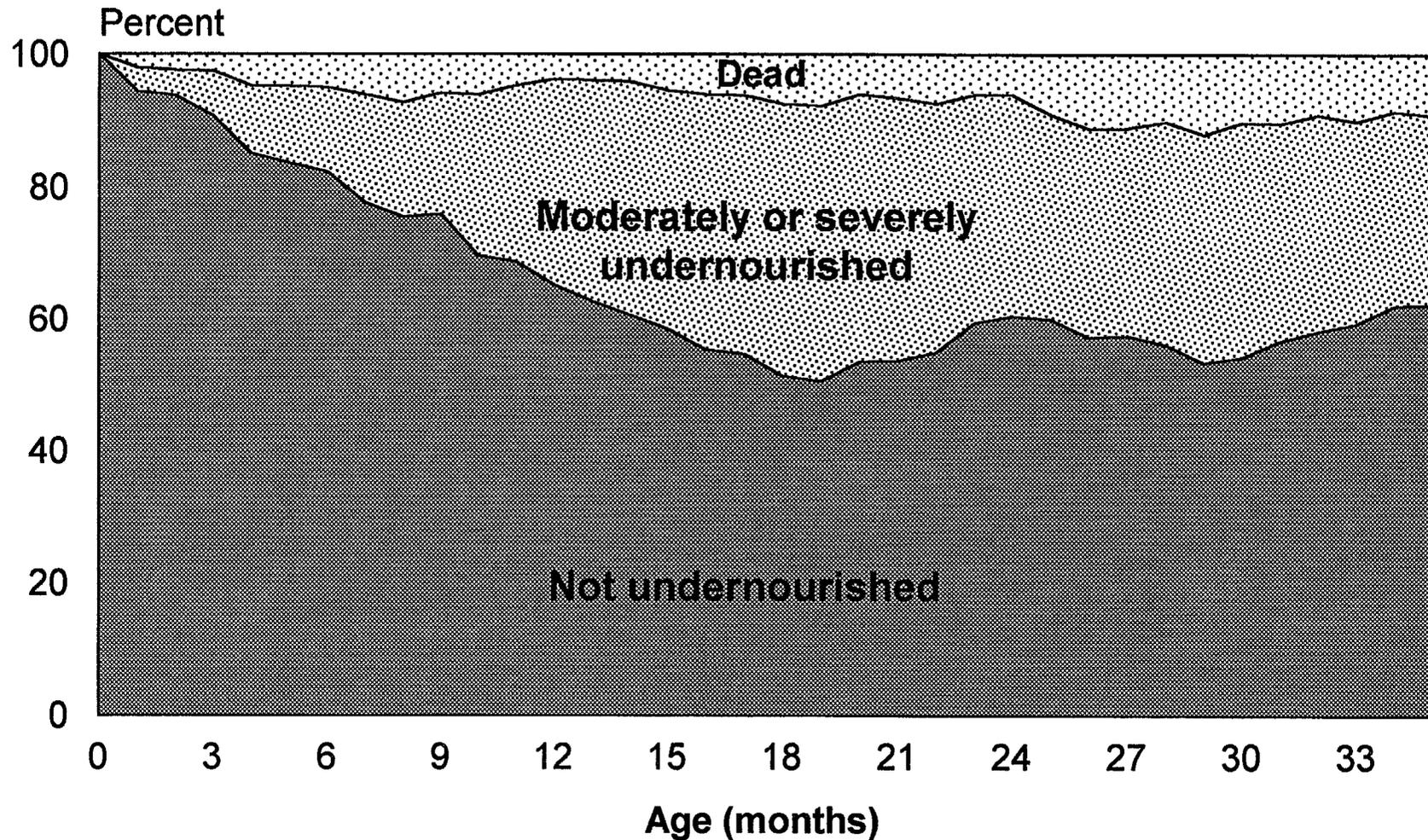
Undernutrition and mortality both take a tremendous toll on young children. This figure illustrates the proportion of children who have died or are undernourished at each age.

In Zimbabwe:

- Between 0 and 18 months of age, the percentage of children who are alive and well nourished drops rapidly.
- **At two years of age, almost 6 percent of children have died, 33 percent are severely or moderately undernourished,¹ and only 61 percent remain alive and well nourished.**

¹A child with a Z-score below -3 SD on the reference standard is considered severely undernourished while one with a Z-score between -3 and -2 SD is considered moderately undernourished.

Figure 16
Survival and Nutritional Status of Children, Zimbabwe



Note: A child with a Z-score below -3 SD on the reference standard is considered severely undernourished while one with a Z-score between -3 and -2 SD is considered moderately undernourished.

Source: ZDHS 1994

Figure 17: Contribution of Undernutrition to Under-five Mortality, Zimbabwe

Undernutrition is an important factor in the death of many young children in Zimbabwe. Formulas developed by Pelletier et al.¹ are used to quantify the contributions of severe and mild-to-moderate undernutrition to under-five mortality.

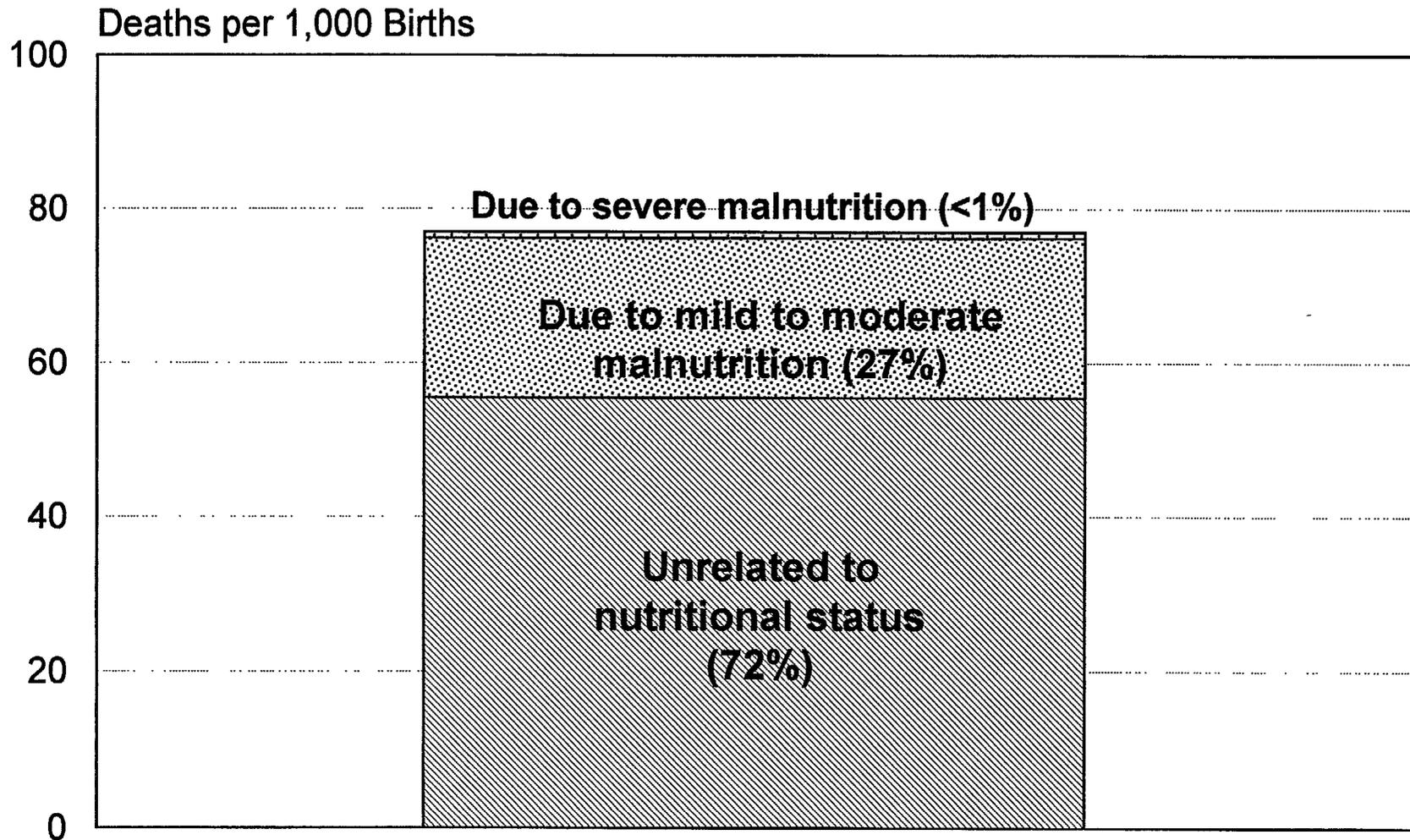
In Zimbabwe:

- **Twenty-two deaths per thousand births are related to undernutrition.** This is 28 percent of all deaths that occur before age five.
- Because of its extensive prevalence, **mild-to-moderate undernutrition contributes to more deaths (21 per 1,000) than does severe undernutrition (1 per 1,000).** Thus, mild-to-moderate undernutrition is implicated in 96 percent of all under-five deaths associated with undernutrition.

¹Pelletier, 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 17

Contribution of Undernutrition to Under-five Mortality, Zimbabwe



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

Source: ZDHS 1994

Figure 18: Undernutrition among Mothers of Children under 3 Years by Region and Residence, Zimbabwe

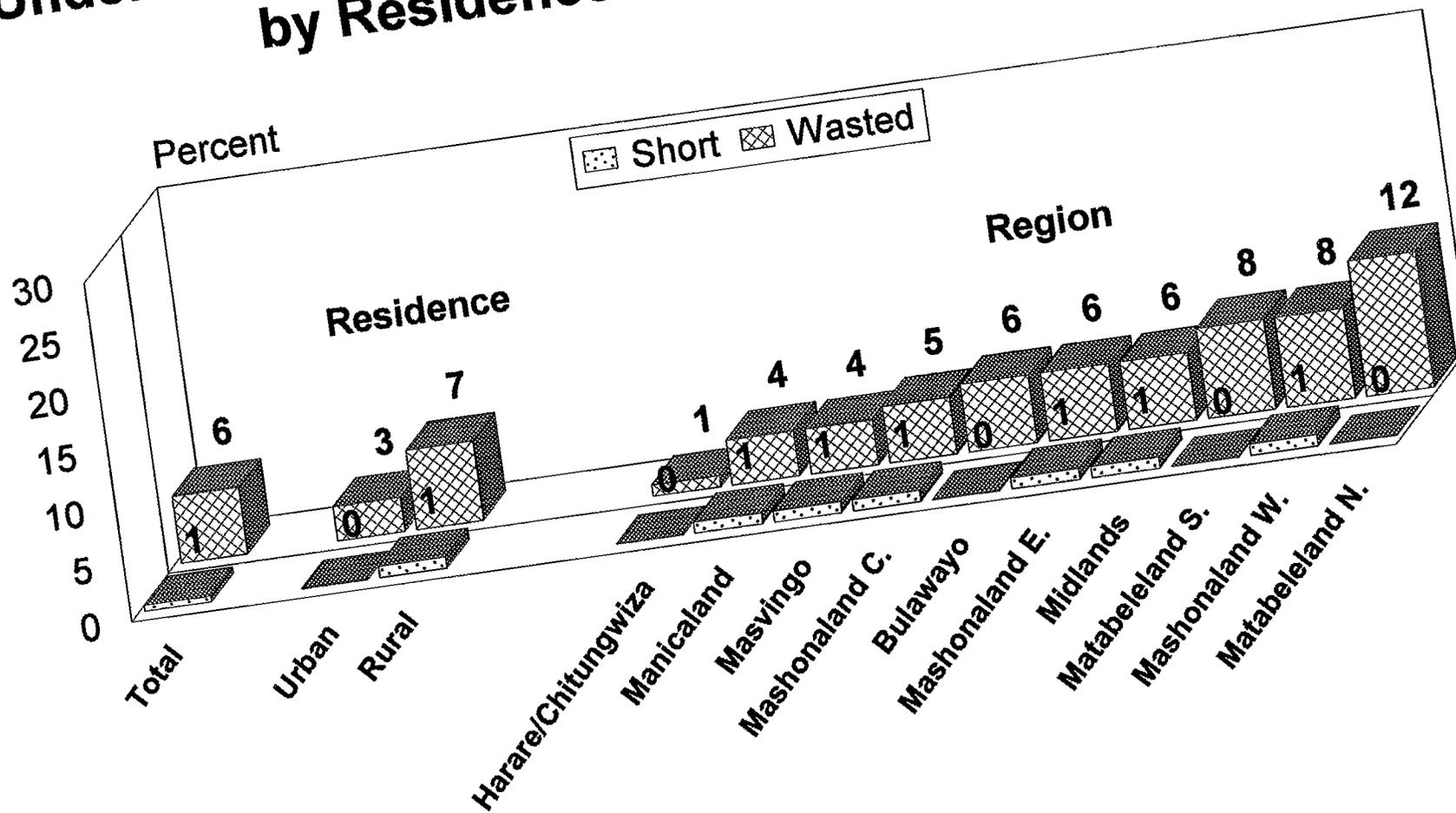
A mother's nutritional status affects her ability to successfully carry, deliver, and care for her children and is of great concern in its own right. While there are no generally accepted cut-off points for indicators of undernutrition among adult women, ad hoc standards can be applied.

Women who are too short—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. Women less than 145 centimeters in height are considered too short.

Wasting, or acute undernutrition in women can be assessed 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 of non-pregnant women falls below the suggested cut-off point of 18.5 kg/m^2 , acute undernutrition is indicated.

- **Six percent of mothers of children under age three in Zimbabwe are wasted (acutely undernourished), while less than 1 percent are too short.**
- **Between 0 and 1 percent of women in both urban and rural areas are too short.**
- **Wasting is more than twice as prevalent among mothers living in rural areas as among those in urban areas.**
- **By region, the highest prevalence of maternal wasting occurs in Matabeleland North, where 12 percent of mothers are acutely undernourished.**

Figure 18
 Undernutrition among Mothers of Children Under 3 Years
 by Residence and Region, Zimbabwe



Note: Short is the percentage of mothers under 1.45 m;
 wasted is the percentage of mothers whose BMI is less than 18.5 kg/m².

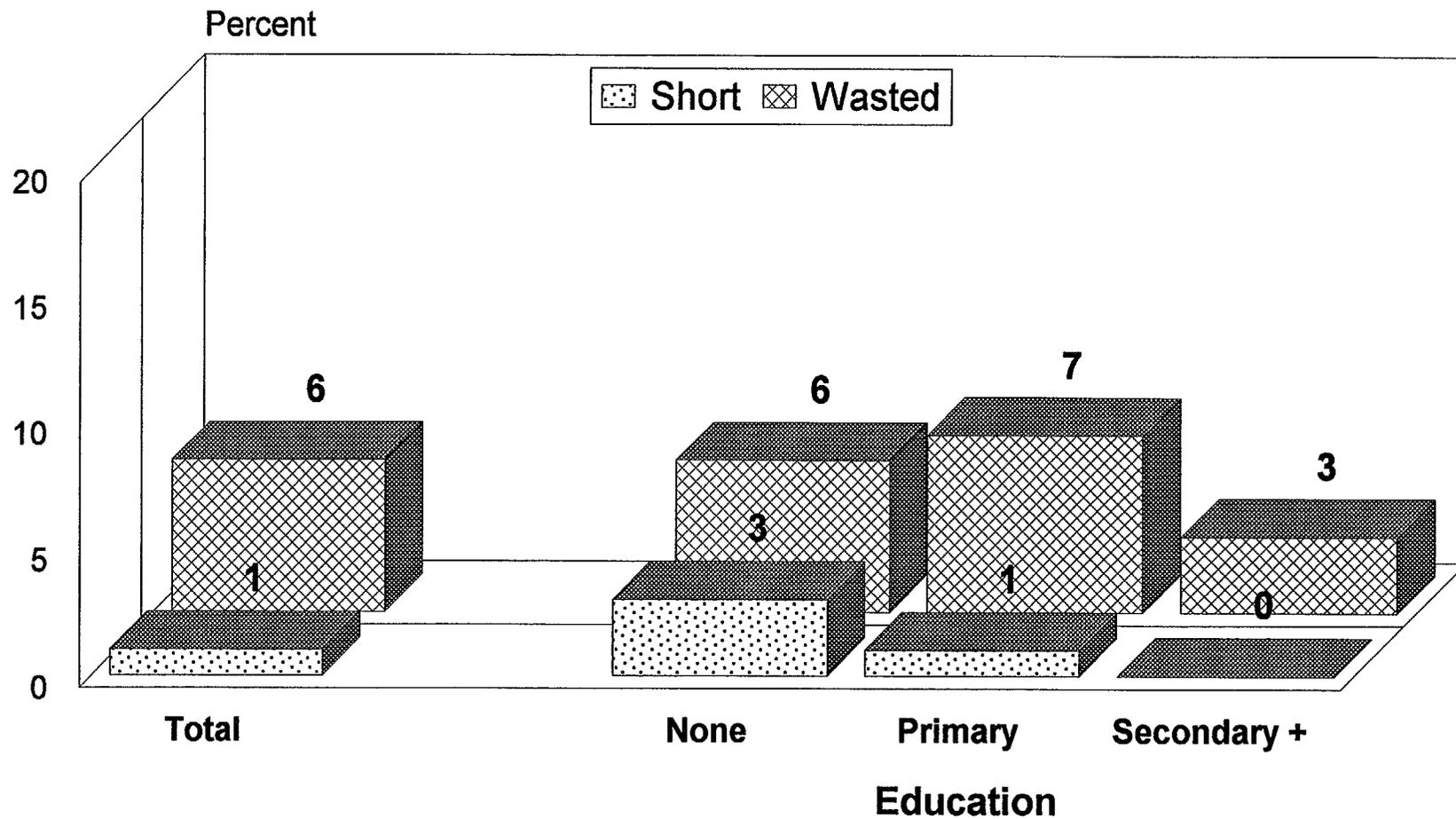
Source: ZDHS 1994

Figure 19: Undernutrition among Mothers of Children under 3 Years by Education, Zimbabwe

In Zimbabwe:

- **The more education a mother has, the less likely it is she will be short.** Among mothers with children under 3 years, none with secondary education was too short, compared with 3 percent of mothers with no education.
- **Having a primary education appears to make little difference whether a woman is likely to be wasted or acutely malnourished, compared with having no education. Having a secondary education, however, reduces the prevalence of wasting by about half, compared with having a primary education or less.**

Figure 19
Undernutrition among Mothers of Children under 3 Years
by Education, Zimbabwe



Note: *Short* is the percentage of mothers under 1.45 m;
wasted is the percentage of mothers whose BMI is less than 18.5 kg/m².

Source: ZDHS 1994

Appendix 1

Stunting, Wasting and Underweight Rates by Background Characteristics Zimbabwe 1994

Background Characteristic	Stunted	Wasted	Under-weight	Background Characteristic	Stunted	Wasted	Under-weight
Child's Age in Months				Region of Residence			
0-5	3.8	3.2	2.2	Bulawayo	12.8	3.2	7.1
6-11	10.9	7.6	10.4	Harare/			
12-17	28.0	7.9	24.2	Chitungwiza	20.9	5.7	14.6
18-23	38.3	6.9	24.3	Manicaland	19.5	6.1	12.8
24-29	27.8	4.6	19.0	Mashonaland C.	27.2	5.1	18.4
30-35	29.0	3.2	20.8	Mathonaland E.	23.1	1.9	11.8
n=2086	p<0.0001	p<0.009	p<0.0001	Mashonaland W.	22.3	6.7	19.6
				Masvingo	24.9	2.1	15.5
				Matabeleland N.	28.6	9.9	24.8
				Matabeleland S.	25.6	4.9	17.5
				Midlands	13.1	7.3	13.9
				n=2086	p<0.0001	p<0.004	p<0.0001
Child's Sex				Location of Residence			
male	22.8	6.8	18.4	rural	24.0	5.7	18.0
female	21.7	4.3	14.3	urban	16.1	5.2	10.4
n=2086	NS	p<0.01	p<0.01	n=2086	p<0.0004	NS	p<0.0001
Overall	22.2	5.6	16.3				

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

NS = Not significant

Appendix 2

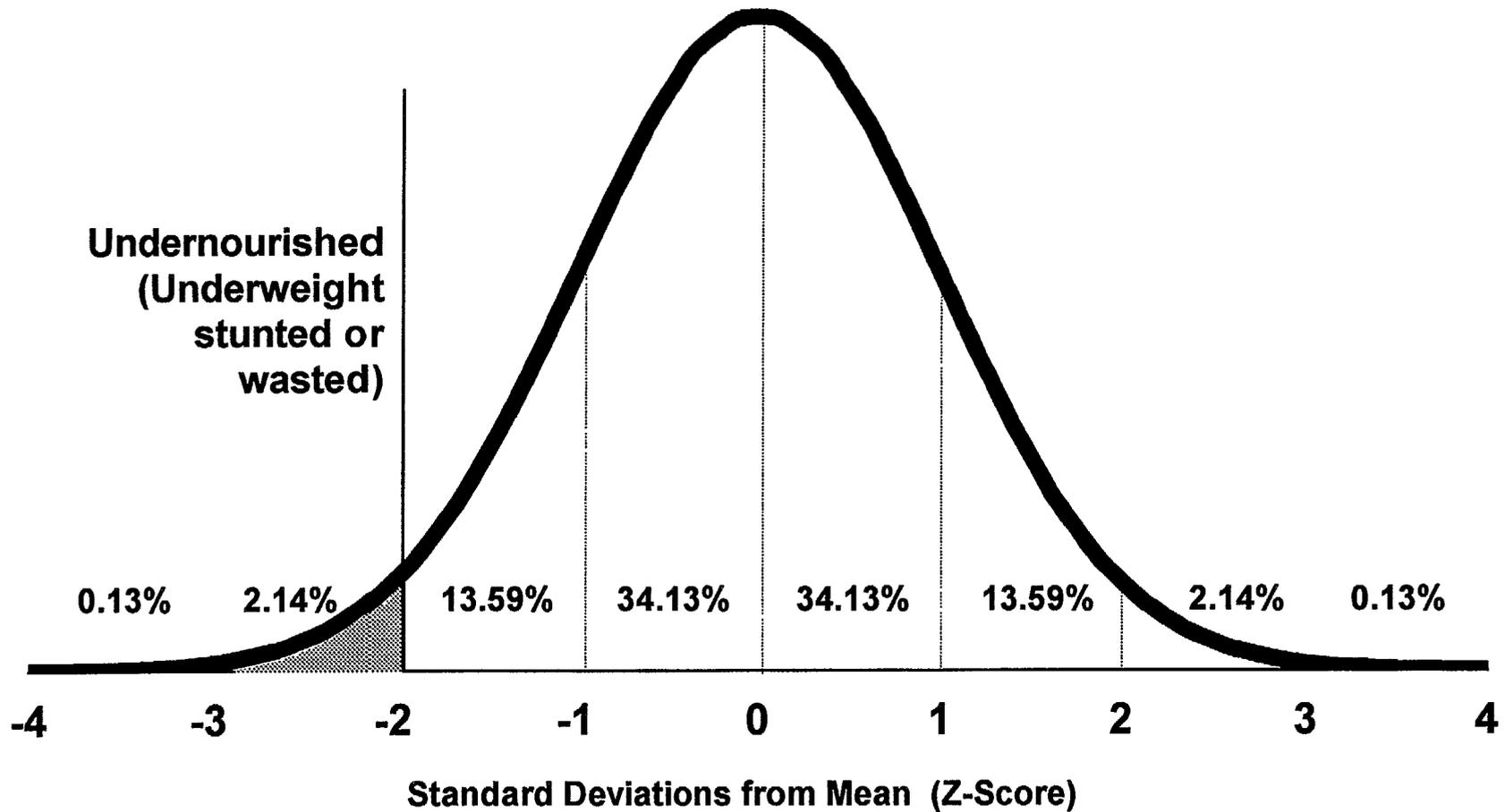
WHO/CDC/NCHS International Reference Population

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 1 standard deviation of the mean for children of that age or height, and a height within 1 standard deviation of the mean for children of that age. About 14 percent of children will be between 1 and 2 standard deviations above the mean; these children are considered relatively tall or overweight for their age, or relatively fat for their height. Another 14 percent will be between 1 and 2 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 very overweight for their age, or very overweight for their height, that is, they are more than 2 standard deviations above the mean. Another 2 percent will fall more than 2 standard deviations below the mean and be considered undernourished. These children are very short (stunted) or very underweight for their age or very thin (wasted) for their height.

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.

Appendix 2

WHO/CDC/NCHS Nutrition Reference Standard Normal Distribution



42.