
Nutrition of Infants And Young Children In Tanzania, 1997

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Macro International Inc.

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NUTRITION OF INFANTS AND YOUNG CHILDREN IN TANZANIA

Findings from the 1996 Tanzania DHS Survey

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Introduction

Malnutrition¹ is one of the most important health and welfare problems among infants and young children in Tanzania. It is a result of both inadequate food intake and poor environmental sanitation. Inadequate food intake is a consequence of insufficient food available at the household level and/or improper feeding practices. Improper feeding practices include both the quality and 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 effect of long-term malnutrition can be a reduction in worker 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 Tanzania data presented here are from the 1996 Tanzania Demographic and Health Survey, a nationally representative survey of 7,969 households conducted by the Bureau of Statistics, Dar es Salaam, Tanzania with technical assistance from the Ministry of Health Dar es Salaam, Tanzania and Macro International Inc.. Funding was provided by the U.S. Agency for International Development. Fieldwork was conducted between July and November 1996. Of the 6,916 living children age 0-59 months that were part of the 1996 TDHS, 5,344 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 diarrhea in the two weeks prior to the survey and on relevant sociodemographic characteristics. For comparison purposes, data are presented from DHS surveys conducted in other sub-Saharan countries and the 1991-92 TDHS.

¹ The technical definitions of *malnutrition* 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: Malnutrition among Children under 5 Years, Tanzania

In Tanzania:

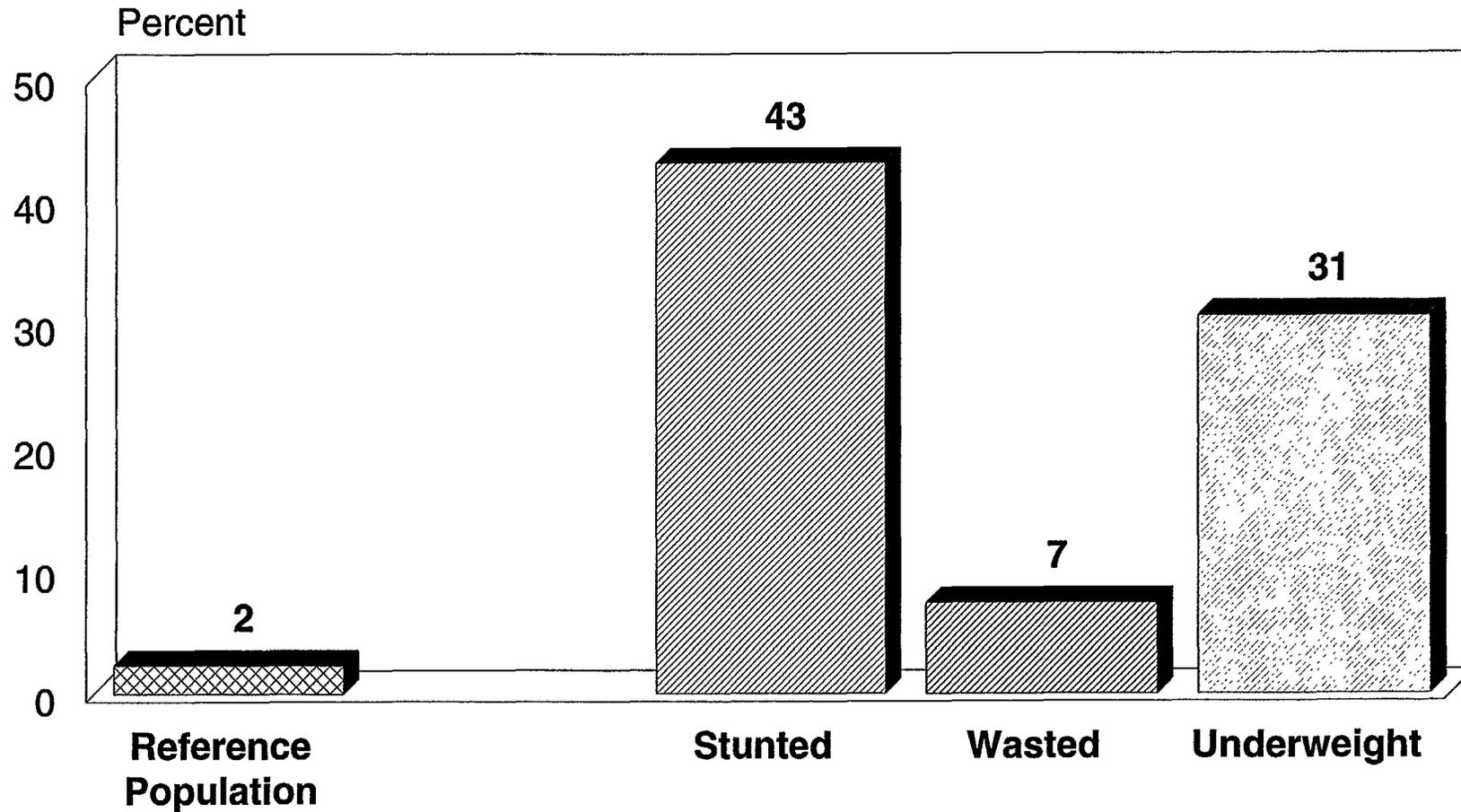
- **Forty-three percent of children aged 0 to 59 months are chronically malnourished.** In other words, they are too short for their age or *stunted*.¹ The proportion of children who are stunted is 22 times the level expected in a healthy, well-nourished population.
- **Acute malnutrition**, manifested by *wasting*,² results in a child being too thin for his or her height. It affects 7 percent of children, which is over three times the level expected in a healthy, well-nourished population.
- **Thirty-one percent of children are *underweight***³ for their age. This is over 15 times the level expected in a healthy, well-nourished population.

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 malnutrition 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 malnutrition is the result of a recent failure to receive adequate nutrition and may be affected by acute illness, especially diarrhea.

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 malnutrition, or a combination of both.

Figure 1
Malnutrition among Children under 5 Years, Tanzania



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

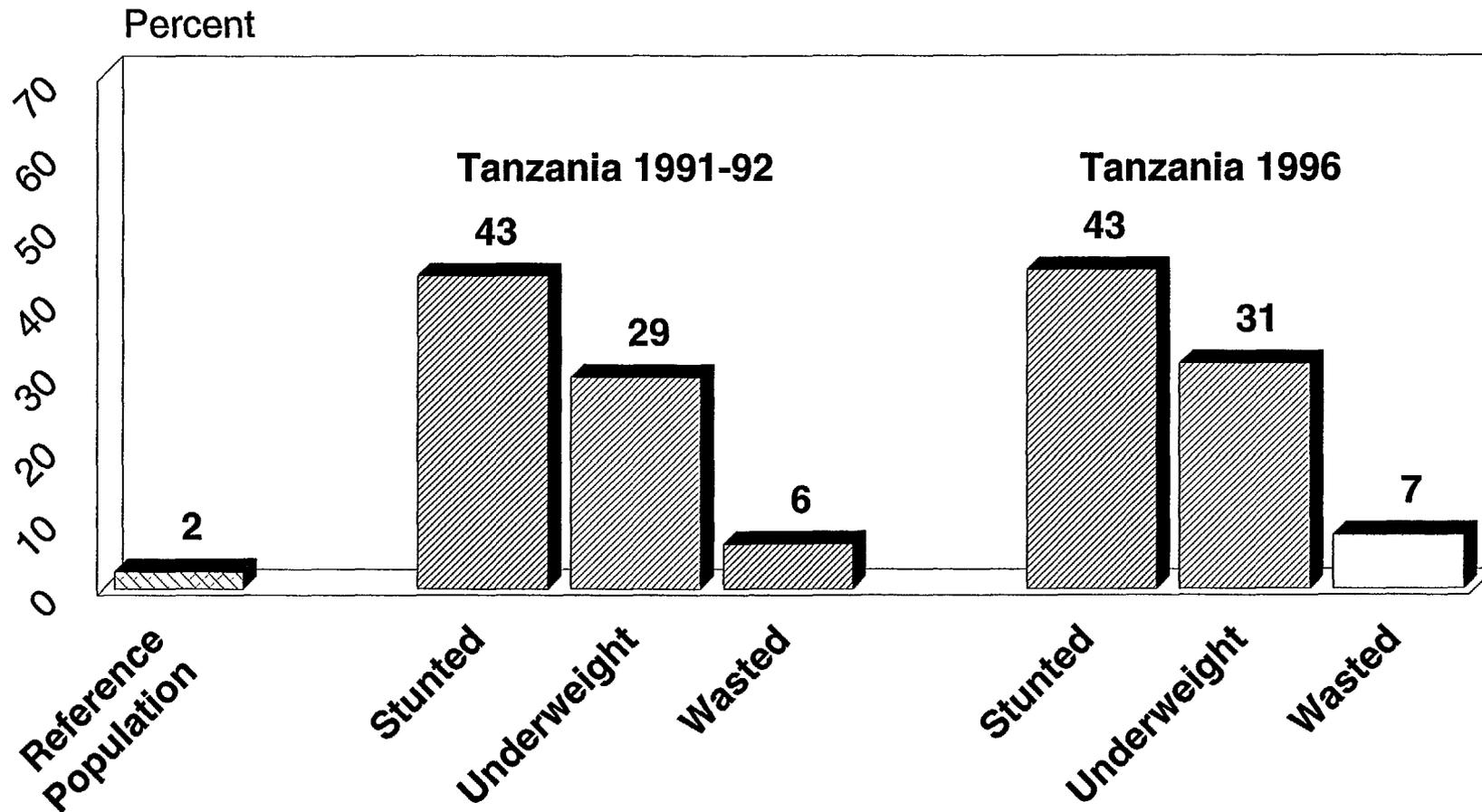
Source: TDHS 1995

Figure 2: Changes in Malnutrition Rates among Children Under 5 Years, Tanzania 1991-92 to 1996

- The findings of the 1996 TDHS suggest that the nutritional status of Tanzanian children under 5 has not significantly changed since the 1991-92 TDHS. Moreover, seasonal differences in food availability do not appear to have a significant effect on children's nutritional status; the earlier survey was conducted between October 1991 and March of 1992 and the later survey was conducted between July and November of 1996.

Figure 2

Changes in Malnutrition Rates among Children under 5 Years, Tanzania 1991-92 to 1996



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

Source: TDHS 1991-92 and 1996

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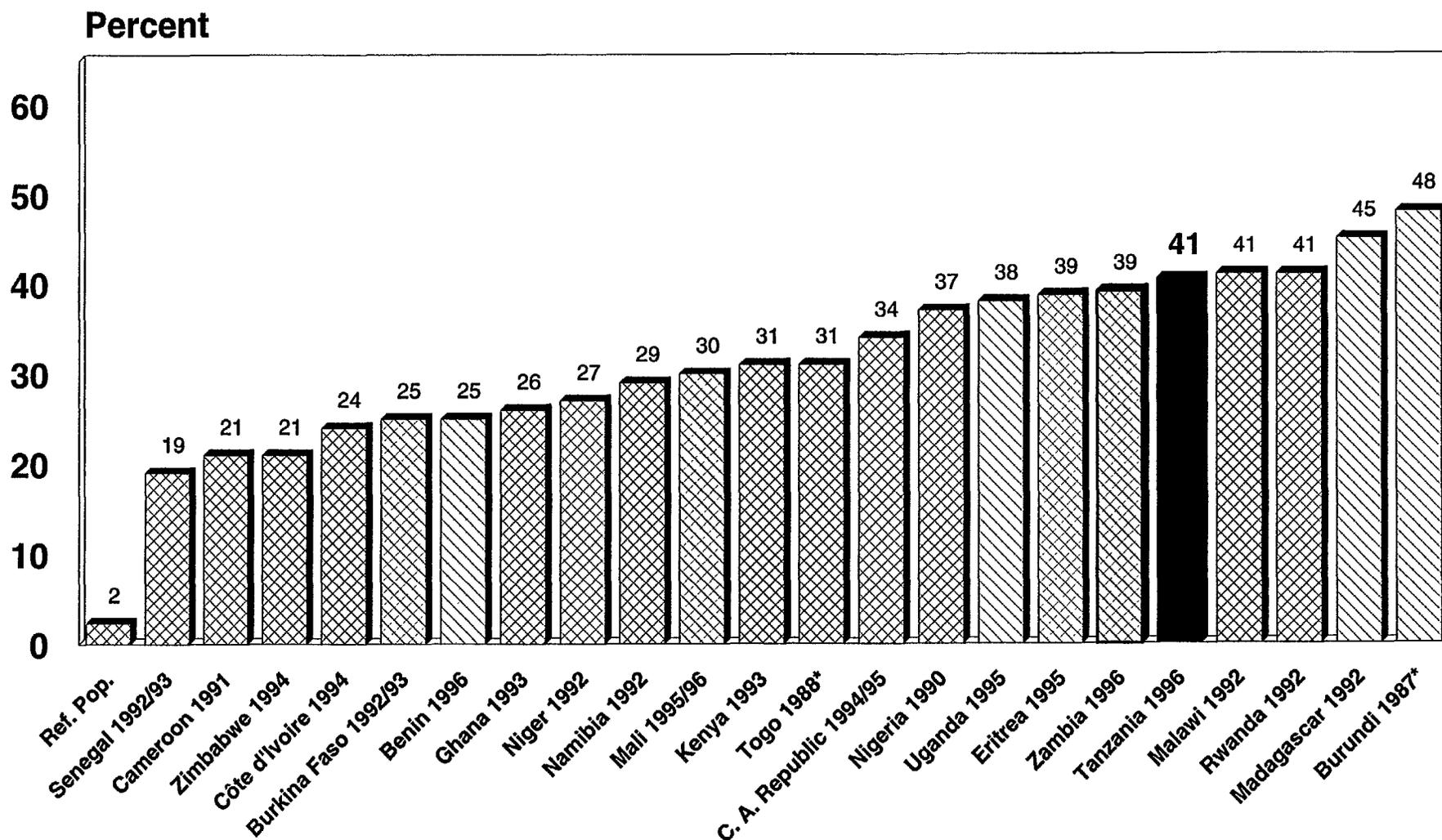
Figure 3: Stunting among Children under 3 Years in Sub-Saharan Countries DHS Surveys 1986-1996

Among the sub-Saharan countries surveyed:

- The percentage of children less than 36 months who are *stunted* ranges from 19 to 48 percent in the countries surveyed. **At 41 percent, the proportion of stunted children in Tanzania falls in the upper middle range of sub-Saharan countries.** 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, recent shifts in social or economic policies.

Figure 3

Stunting among Children under 3 Years in Sub-Saharan Countries DHS Surveys 1986-1996



Note: Stunting reflects chronic malnutrition.

* Children 3-35 months only

Source: DHS Surveys 1986-1996

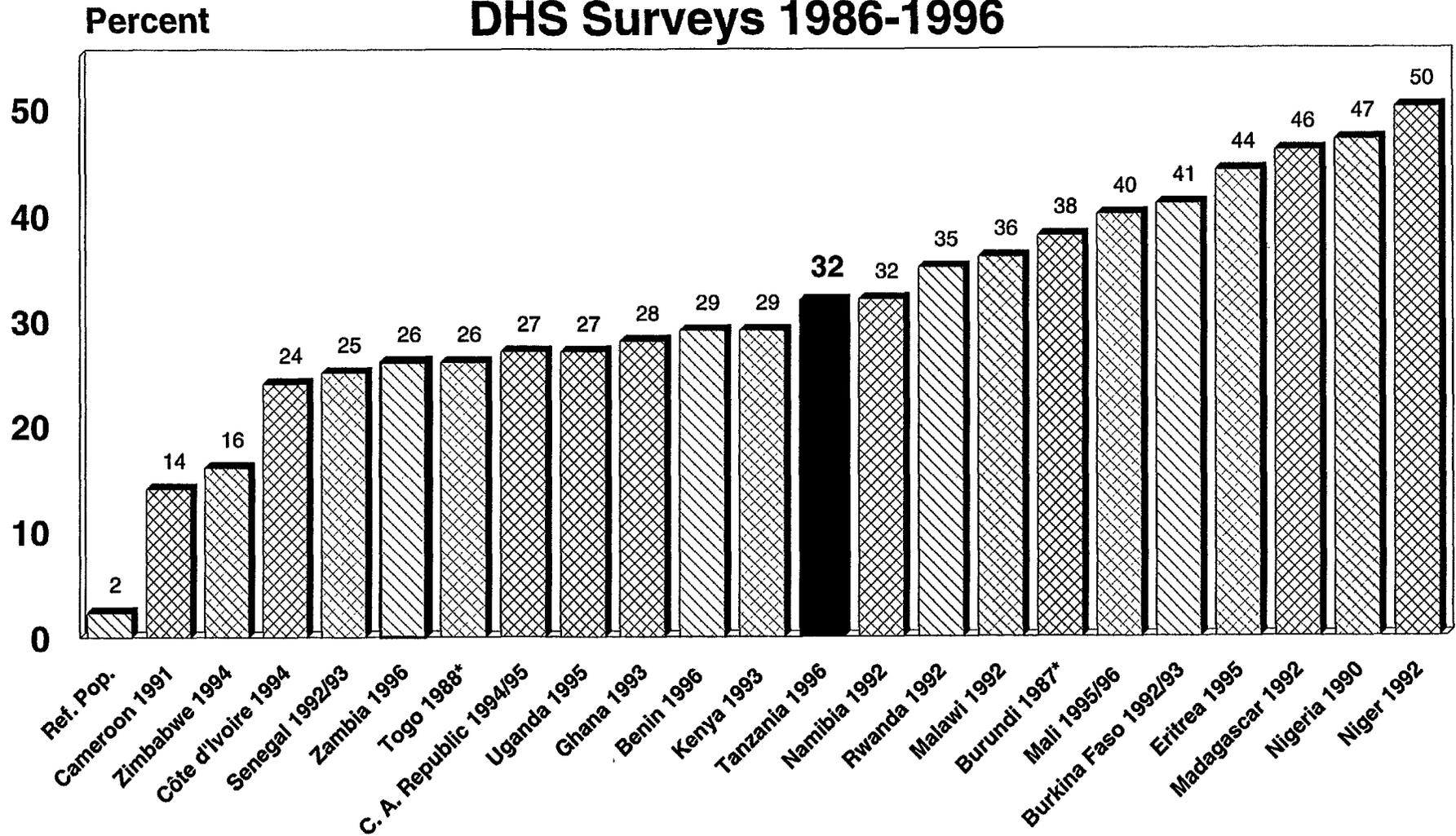


Figure 4: Underweight among Children under 3 Years in Sub-Saharan Countries DHS Surveys 1986-1996

Among the sub-Saharan countries surveyed:

- The percentage of children less than 36 months who are *underweight* ranges from 14 to 50 percent in the countries surveyed. **At 32 percent, the proportion of underweight children in Tanzania falls in the middle range of sub-Saharan countries.** Because underweight represents either children who suffer from chronic or acute malnutrition, or both, underweight is 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 4
Underweight among Children under 3 Years
in Sub-Saharan Countries
DHS Surveys 1986-1996



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

* Children 3-35 months only

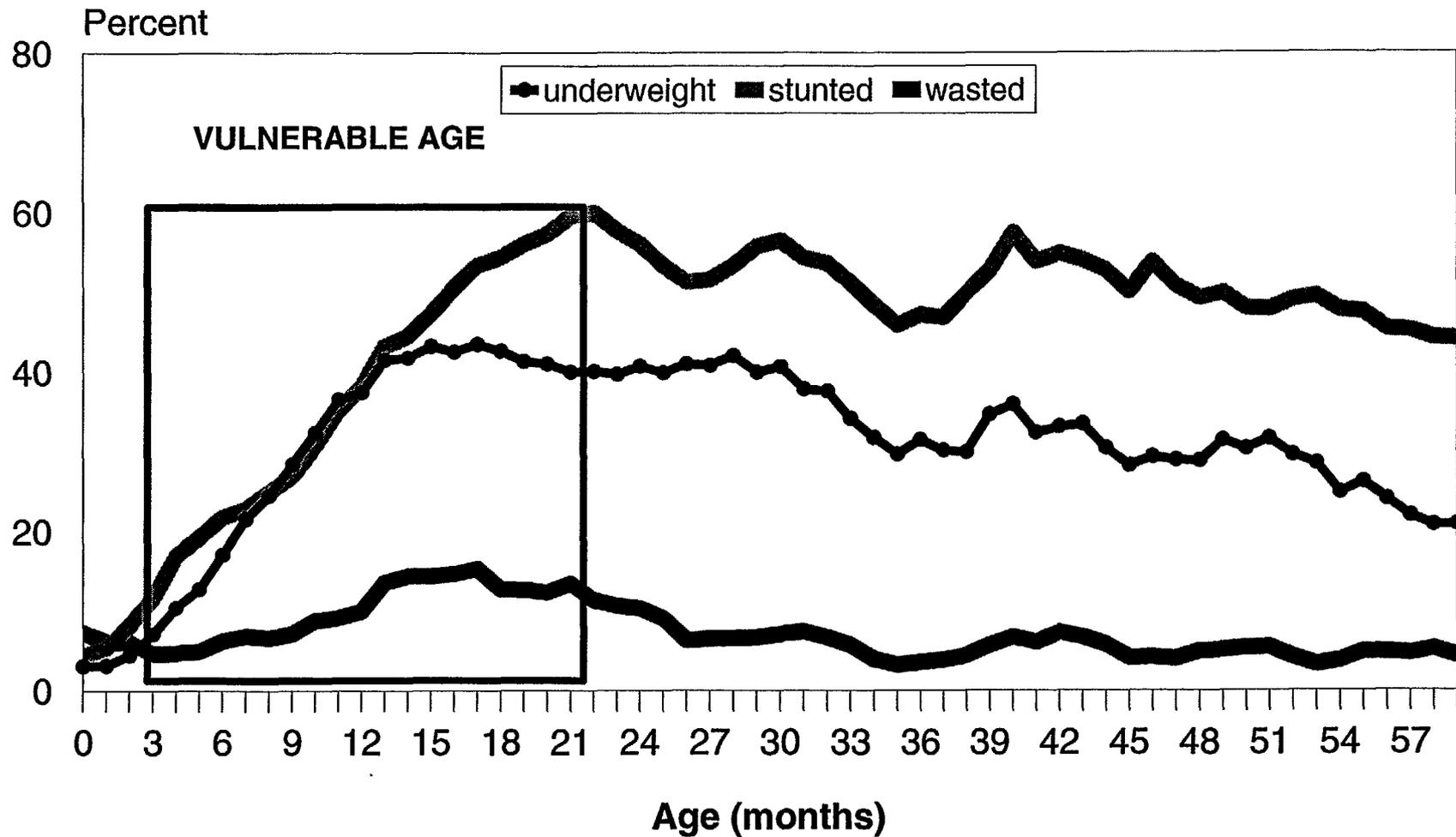
Source: DHS Surveys 1986-1996

Figure 5: Stunting, Wasting and Underweight by Age, Tanzania

In Tanzania, the time between 3 months and 22 months of age is a vulnerable period:

- **The proportion of children stunted increases rapidly from 1 month to 22 months of age, at which time it peaks at about 60 percent.** The proportion of children stunted then gradually drops between 23 and 59 months to around 45 percent. This pattern highlights the first two years of life as the most nutritionally vulnerable for children in Tanzania.
- **The proportion of children wasted slowly rises from 3 to 17 months of age, peaking at about 13 percent and remains at this level through 21 months of age.** Toward the end of the second year of life, the proportion of wasted children drops to 4 percent and remains at this low level further emphasizing the vulnerability of children under two years.
- **The proportion of children underweight increases very rapidly from 3 months to 15 months of age, peaking at about 47 percent.** Underweight rates remain at this high level through 30 months and then gradually decrease to 25 percent.

Figure 5
**Stunting, Wasting and Underweight
 by Age, Tanzania**



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

Source: TDHS 1996

Figure 6: Feeding Practices for Infants under 4 Months, Tanzania

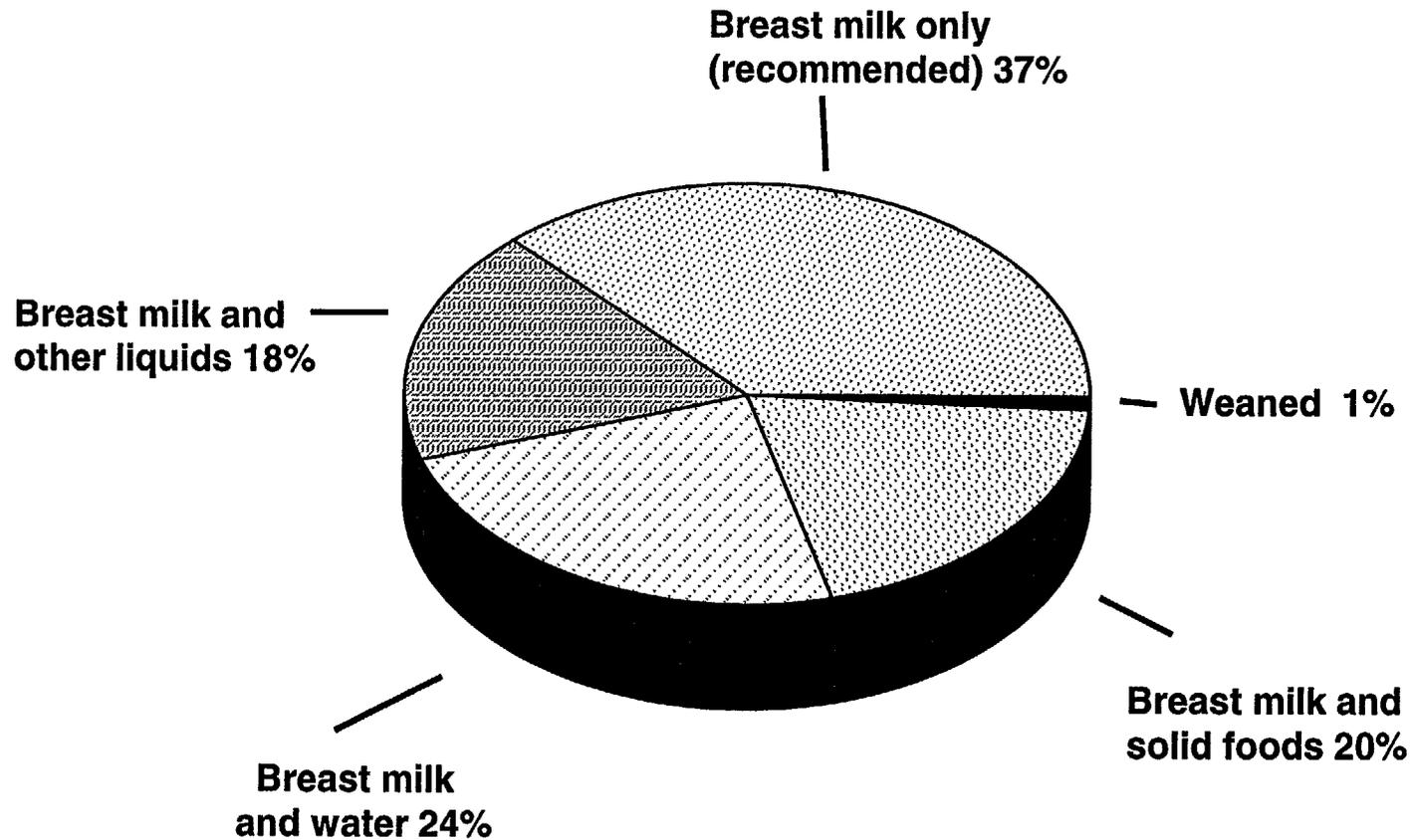
Improper feeding practices, in addition to diarrheal disease, are important determinants of malnutrition. The World Health Organization (WHO) recommends that *all infants be exclusively breastfed from birth until about 6 months of age*¹¹. In other words, infants should be fed only breast milk during the first months of their lives.

In Tanzania, the introduction of liquids, such as water, sugar water, juice, formula, and solid foods, takes place 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 diarrheal disease.

- **In Tanzania, only 37 percent of children under the age of 4 months are exclusively breastfed, as is recommended by WHO.**
- **Thirty-nine percent of infants under 4 months old are given some form of supplements other than water, which is not recommended. This is an increase since the 1992 TDHS where 30 percent of mothers were reported to use this feeding practice.**

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

Figure 6
Feeding Practices for Infants under 4 Months, Tanzania



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

Source: TDHS 1996

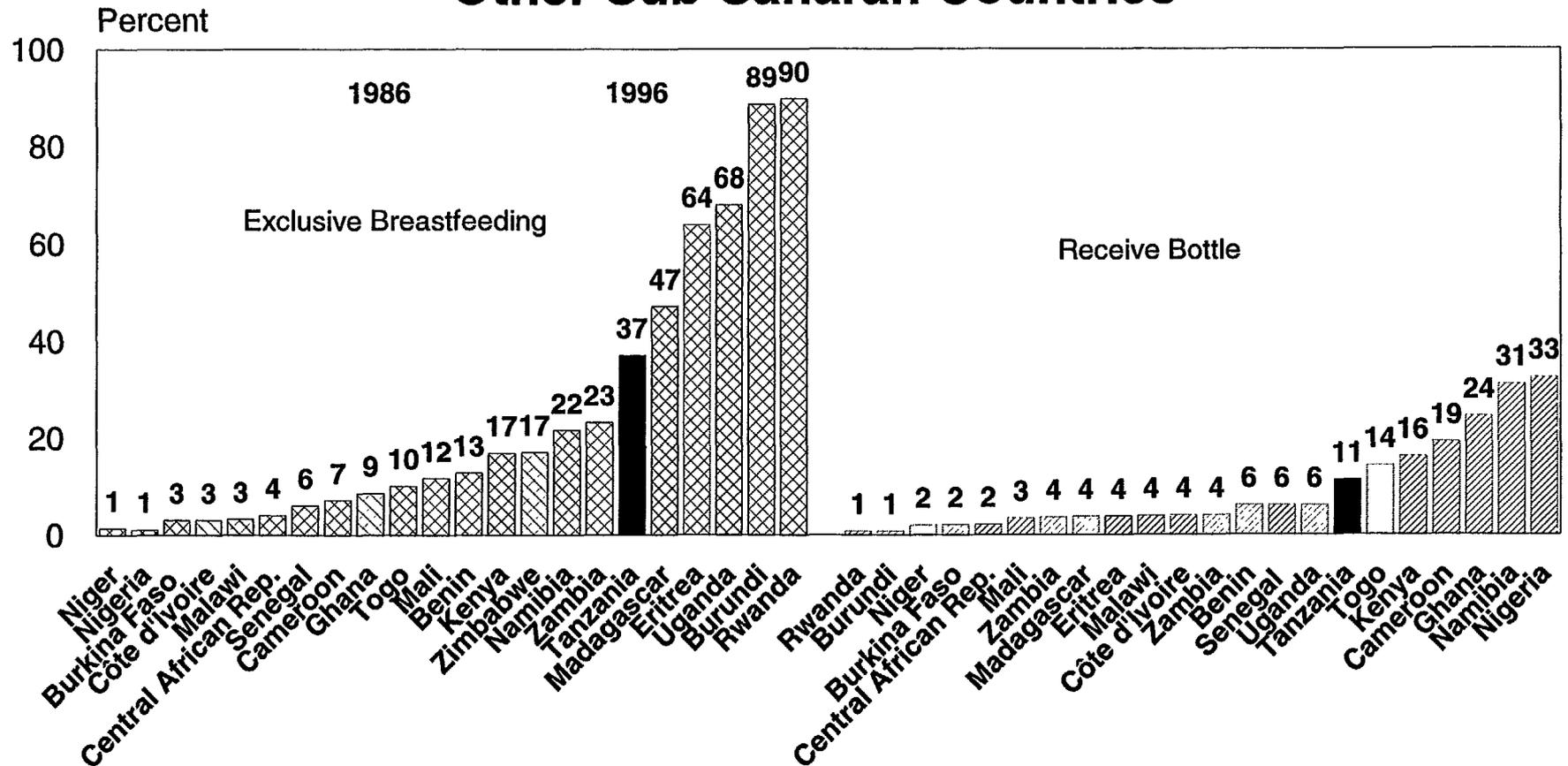
Figure 7: Infants under 4 Months Who are Exclusively Breastfed and Those Who Receive a Supplemental Bottle in Tanzania Compared with Other Sub-Saharan Countries

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

- In most of the sub-Saharan countries surveyed, relatively few mother of infants under 4 months follow the recommended practice of breastfeeding exclusively. In Tanzania, **37 percent of mothers breastfeed their young infants exclusively**. This places Tanzania in the upper/middle range of sub-Saharan countries surveyed, but far from the WHO recommendation.
- **Bottle feeding, which is not recommended by WHO, is used by 11 percent of mothers of infants under 4 months in Tanzania**. The proportion of mothers who bottle feed their children has nearly tripled since the 1992 TDHS.

Figure 7

Infants under 4 Months Who Are Exclusively Breastfed and Those Who Receive a Supplemental Bottle in Tanzania 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.

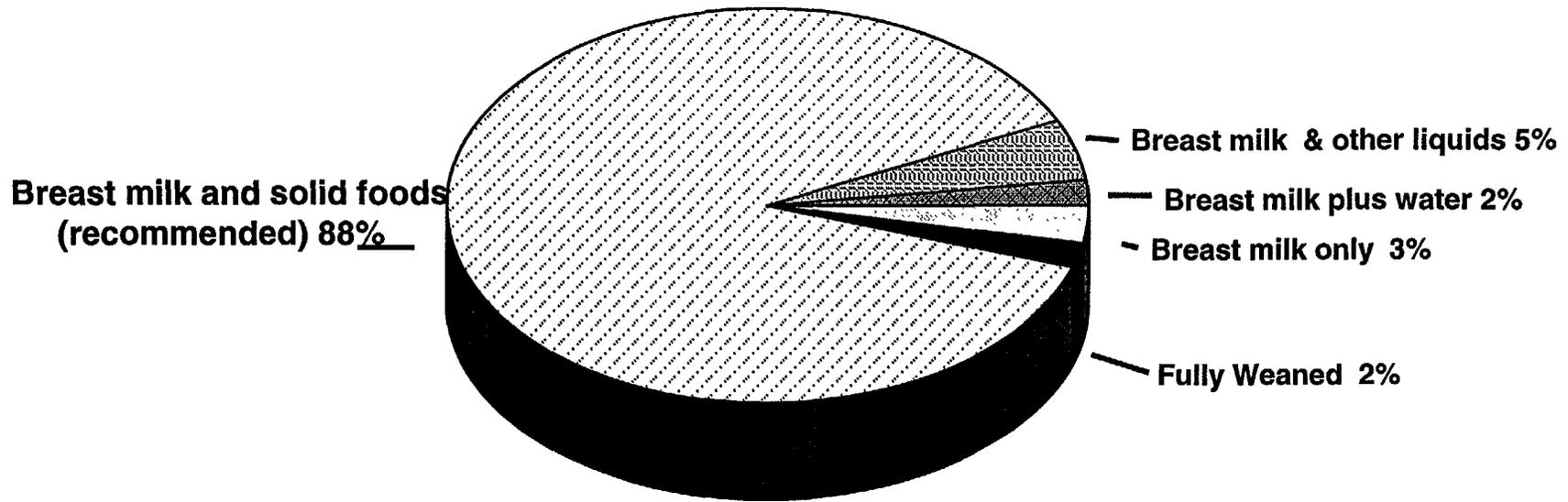
Source: DHS Surveys 1986-1996

Figure 8: Feeding Practices for Infants Age 6 to 9 Months, Tanzania

The World Health Organization 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.

- **Eighty-eight percent of Tanzanian 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 has increased by 52 percent since the 1992 TDHS.**
- **Only about 3 percent of infants age 6 to 9 months are exclusively breast fed; 2 percent are fully weaned from the breast.**

Figure 8
Feeding Practices for Infants Age 6 to 9 Months, Tanzania



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

Source: TDHS 1996

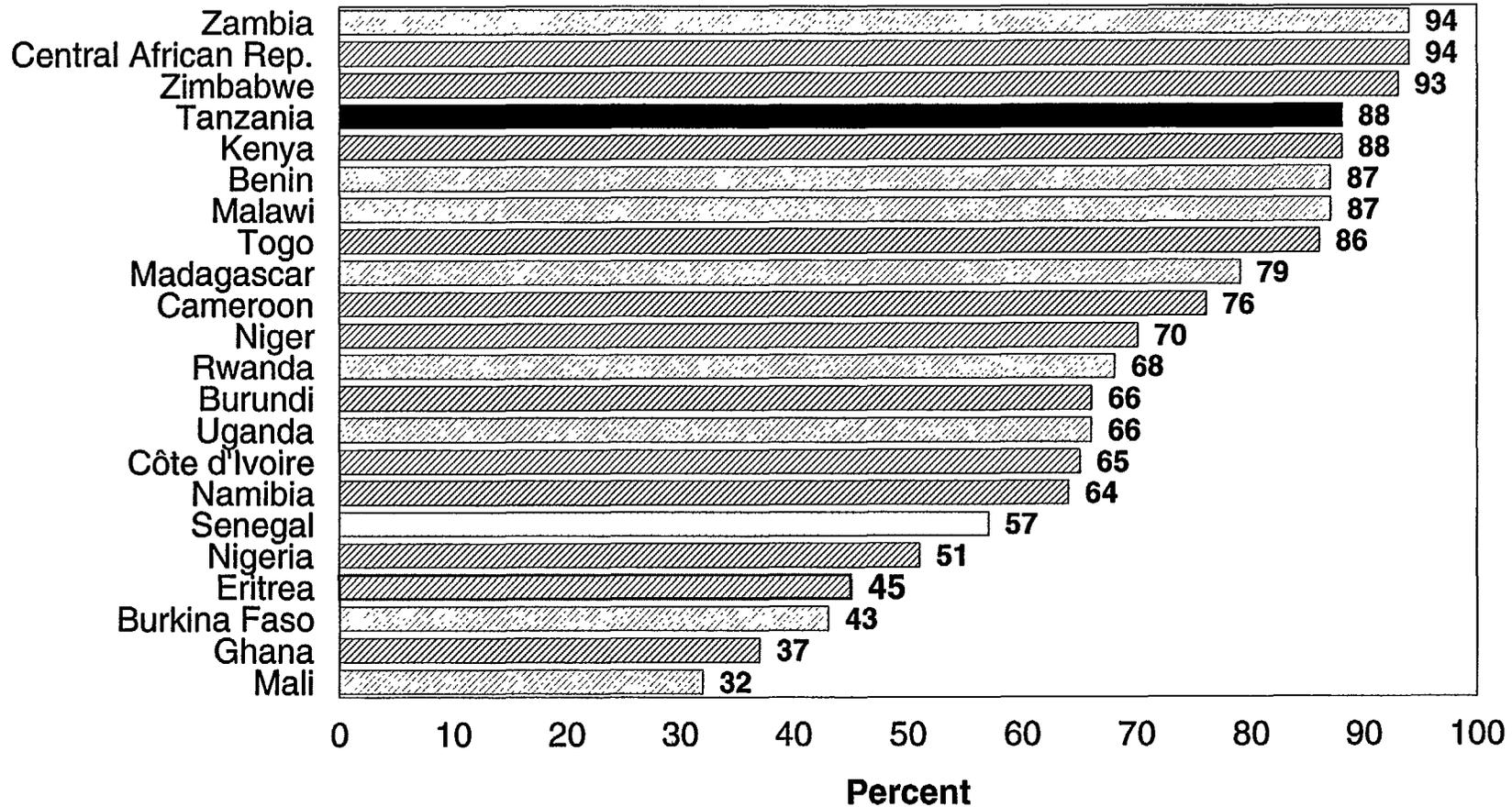
Figure 9: Infants Age 6 to 9 Months Receiving Solid Foods in Addition to Breast Milk in Tanzania Compared with Other Sub-Saharan Countries

In Tanzania :

- **Eight-eight percent of Tanzanian infants age 6 to 9 months receive solid food in addition to breast milk.** This is one of the highest rates among the countries surveyed, indicating a high degree of compliance with World Health Organization recommendations, and a significant increase in this feeding practice since the 1992 TDHS.

Figure 9

Infants Age 6 to 9 Months Receiving Solid Foods in Addition to Breast Milk in Tanzania 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.

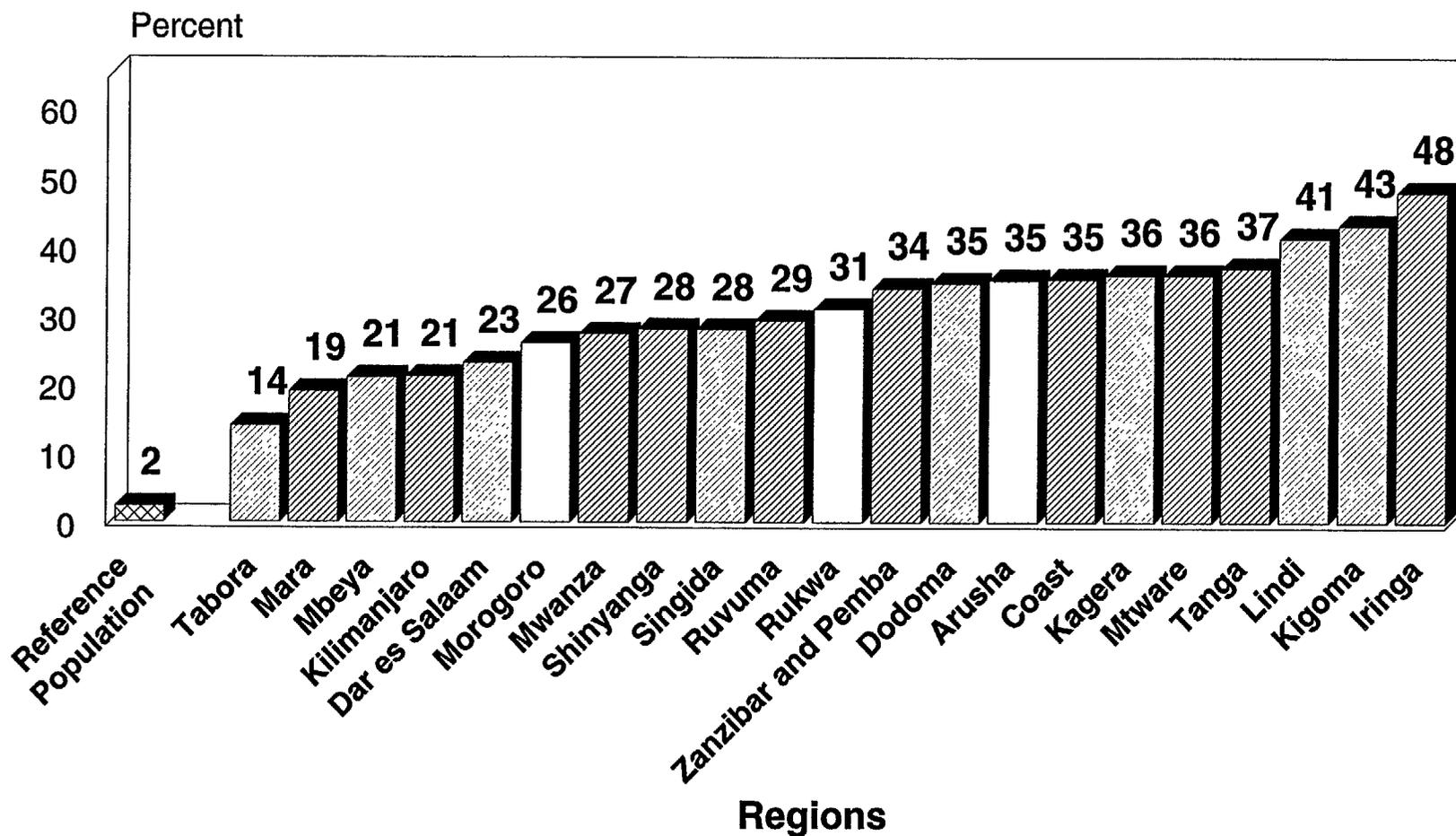
Source: DHS Surveys 1986-1996

Figure 10: Underweight among Children under 5 Years by Regions, Tanzania

In Tanzania:

- **In 16 of the 21 regions, underweight occurs in over a quarter of children.**
- **Children living in the Iringa region are more than 3 times as likely to be underweight as those living in Tabora, and twice as likely as those in Dar es Salaam.**

Figure 10
**Underweight among Children under 5 Years
 by Regions, Tanzania**



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

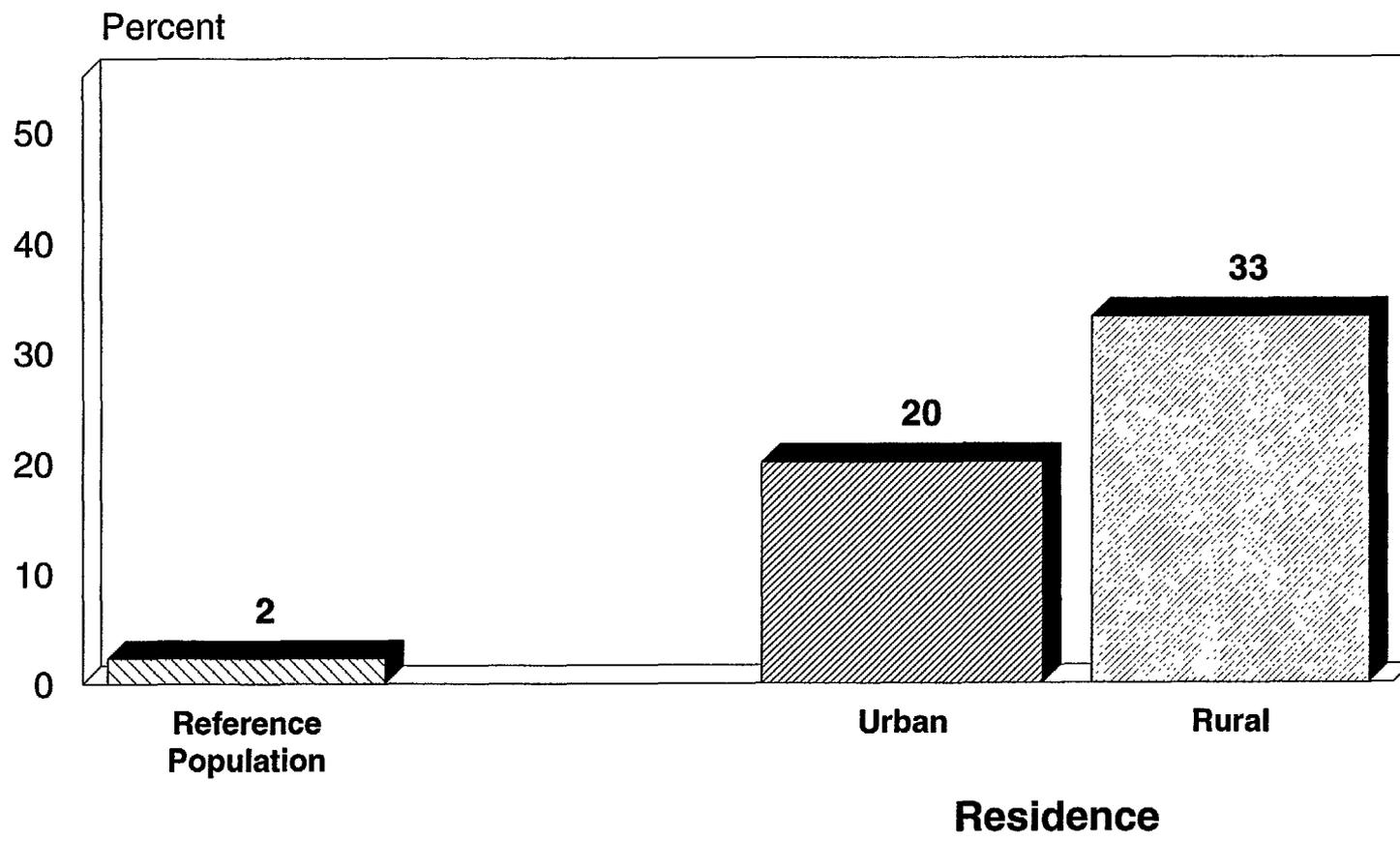
Source: TDHS 1996

Figure 11: Underweight among Children under 5 Years by Residence, Tanzania

In Tanzania:

- **In rural areas, 33 percent of children under 5 years of age are underweight.**
- **Urban children are less likely than their rural counterparts to be underweight; 20 percent of urban children under 5 years are underweight.**

Figure 11
**Underweight among Children under 5 Years
by Residence, Tanzania**



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

Source: TDHS 1996

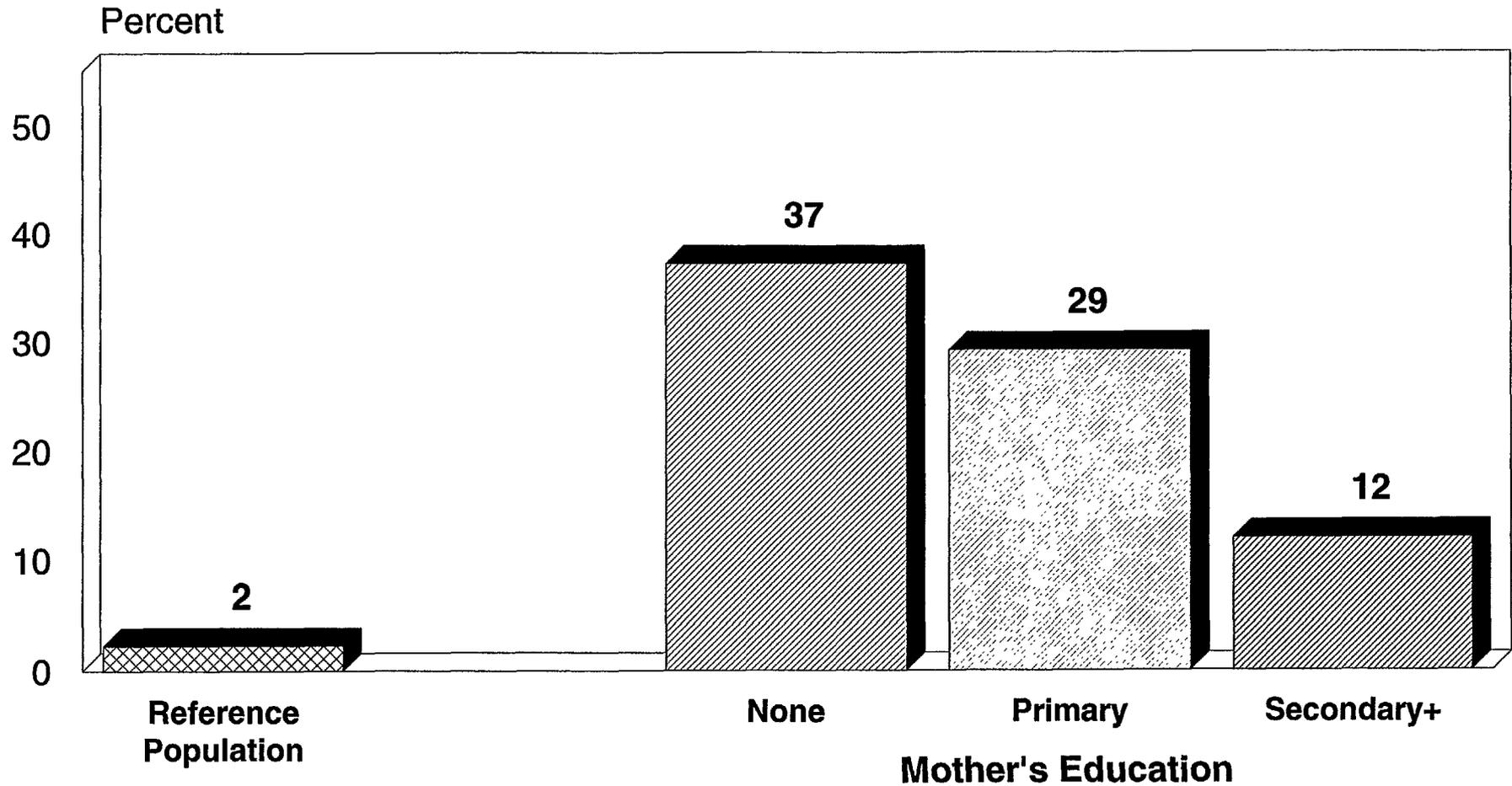
Figure 12: Underweight among Children under 5 Years by Mother's Education, Tanzania

Maternal education is related to knowledge of good child-care practices and to household wealth. In Tanzania, 29 percent of the mothers of children under 5 years of age have never attended school, while 68 percent have primary education and 3 percent have secondary or higher education. There are large variations in school attendance especially between urban and rural areas. In the rural areas, 32 percent of the mothers have never attended school and only 1 percent have gone to secondary school. In contrast, 13 percent of the mothers in urban areas have never attended school and 12 percent have gone to secondary school.

- **Maternal education has an inverse linear relationship with child malnutrition; as the level of maternal education increases, the level of childhood malnutrition decreases.**
- **Malnutrition is three times higher among children of mothers with no education than among children of mothers with secondary or higher education.**

Figure 12

Underweight among Children under 5 Years by Mother's Education, Tanzania



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

Source: TDHS 1996

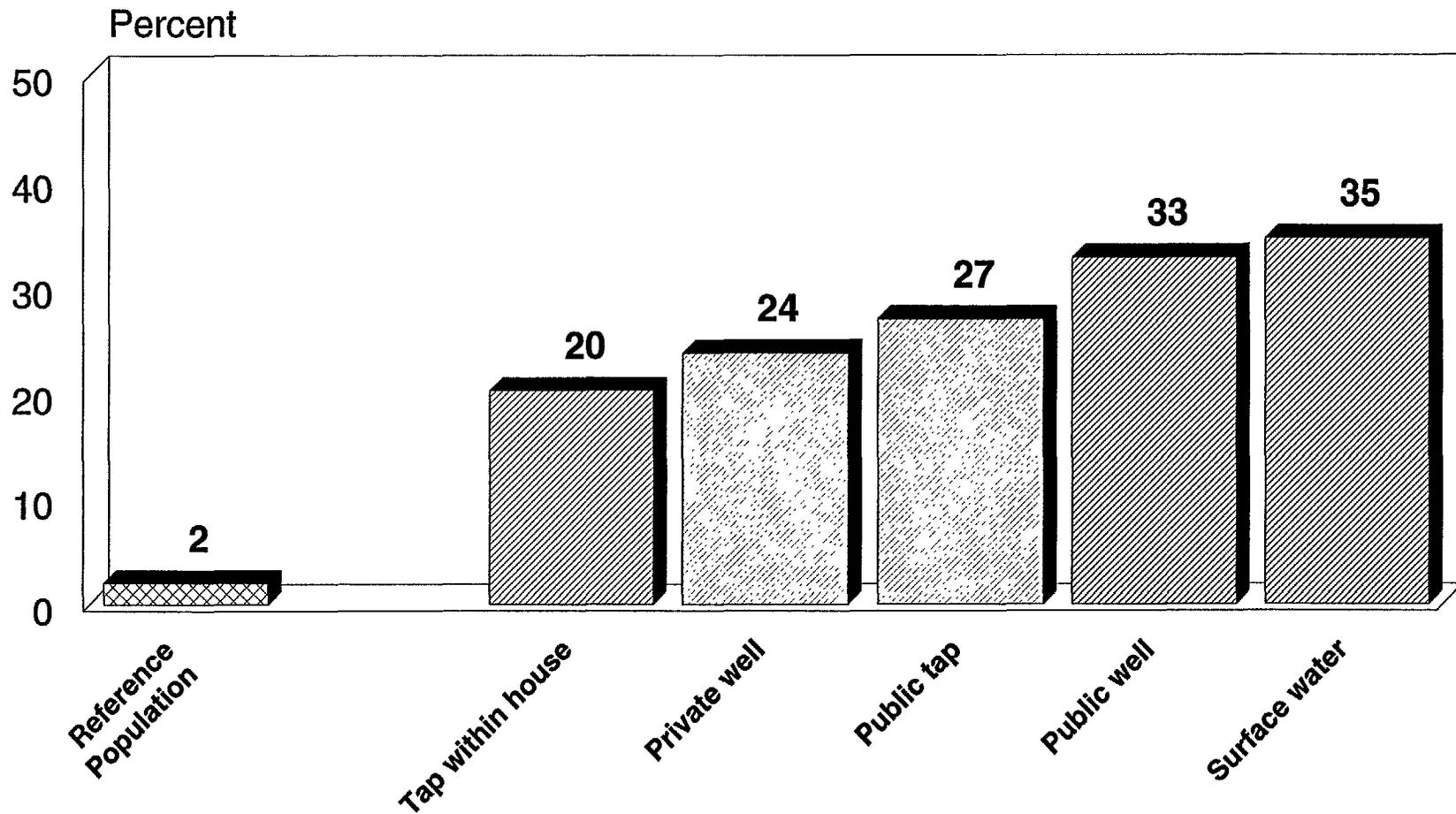
Figure 13: Underweight among Children under 5 Years by Source of Drinking Water, Tanzania

A household's source of drinking water is linked with wealth and hygiene. Poor households are likely to obtain drinking water from contaminated sources such as surface water or open wells. Without an adequate supply of good quality water, a household's hygiene is inadequate and the risk of food contamination increases. As a result, the risks of diarrheal disease and malnutrition rise. Among the Tanzanian households surveyed with children under 5: 36 percent use open water sources, 30 percent obtain their drinking water from a public well, 26 percent use a public tap, 7 percent have a private tap and 1 percent have a private well.

Infants and children from households that do not have tap water are at greater risk of being malnourished than those from households with this amenity. This reflects not only the association between hygiene (and the risk of diarrheal disease) and nutritional status, but also household wealth. Wealth helps determine the quality and quantity of a household's food supply and access to health services as well as its access to tap water. Although easy access to tap water may be associated with a reduced risk of malnutrition, it does not ensure that a child will be well nourished.

- **Over a third of children from households that use surface water sources for their drinking water are Underweight.**
- **Even among households with a water tap within the house, 20 percent of children are underweight.**

Figure 13
Underweight among Children under 5 Years by Source of Drinking Water, Tanzania



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

Source: TDHS 1996

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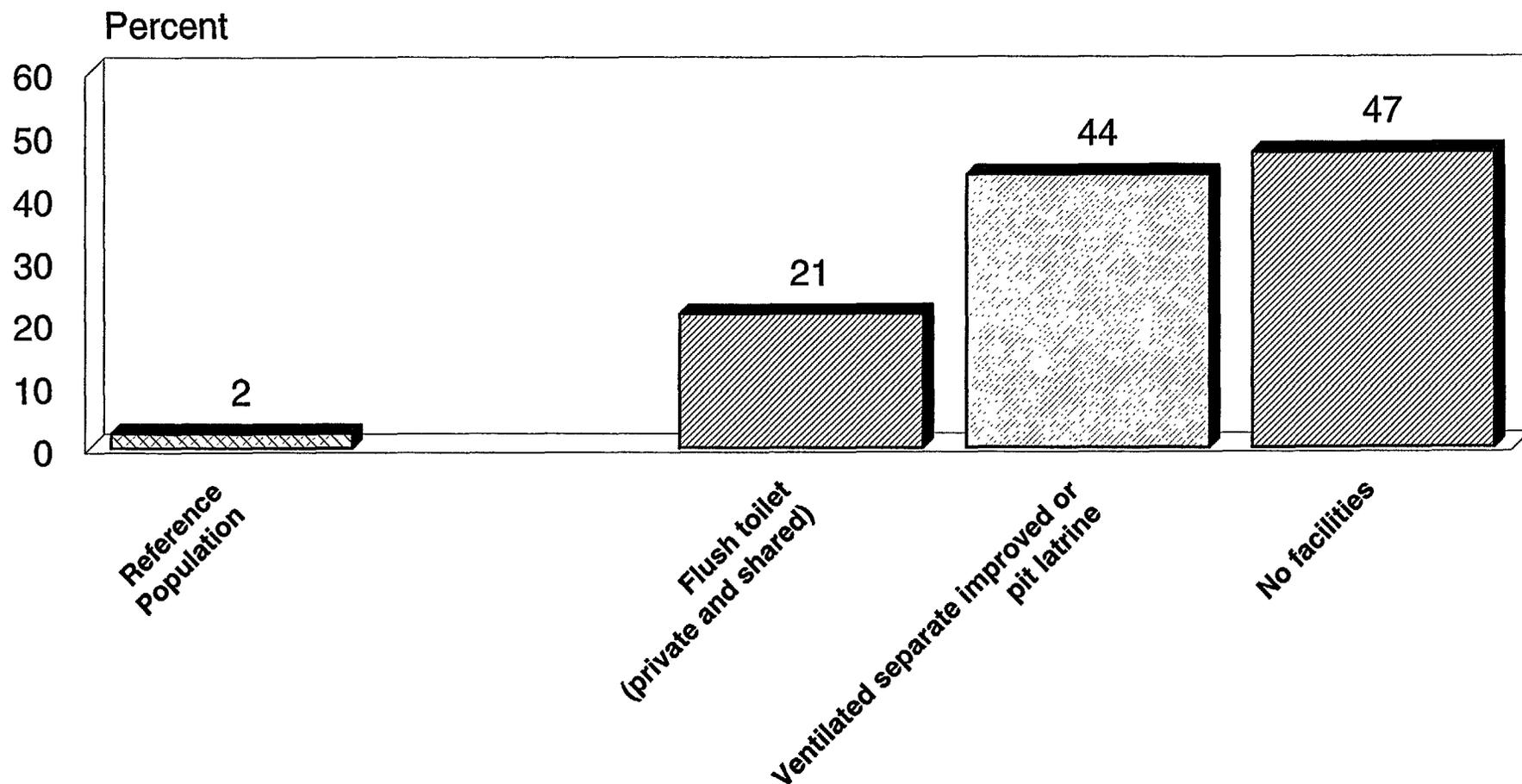
Figure 14: Underweight among Children under 5 Years by Type of Toilet, Tanzania

The type of toilet used by a household reflects household wealth and contributes to environmental sanitation. Poor households are less likely to have adequate toilet facilities. Poor sanitation results in an increased risk of diarrheal disease, which contributes to malnutrition. In Tanzania, 85 percent of survey households with children under 5 have either a ventilated separate improved or traditional pit latrine, 13 percent have no facilities, and 2 percent have a private or shared flush toilet.

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. As with the source of drinking water, this reflects not only the association between environmental sanitation and nutritional status, but also household wealth. While easy access to a flush toilet may be associated with a reduced prevalence of malnutrition, it does not ensure that a child will be well nourished.

- **Children from households with no toilet facilities are more than two times as likely to be underweight as children from households with a flush toilet.**
- **Even in households with access to flush toilets, the proportion of children underweight is still 10 times that of the reference population.**

Figure 14
**Underweight among Children under 5 Years by
Type of Toilet, Tanzania**



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

Source: TDHS 1996

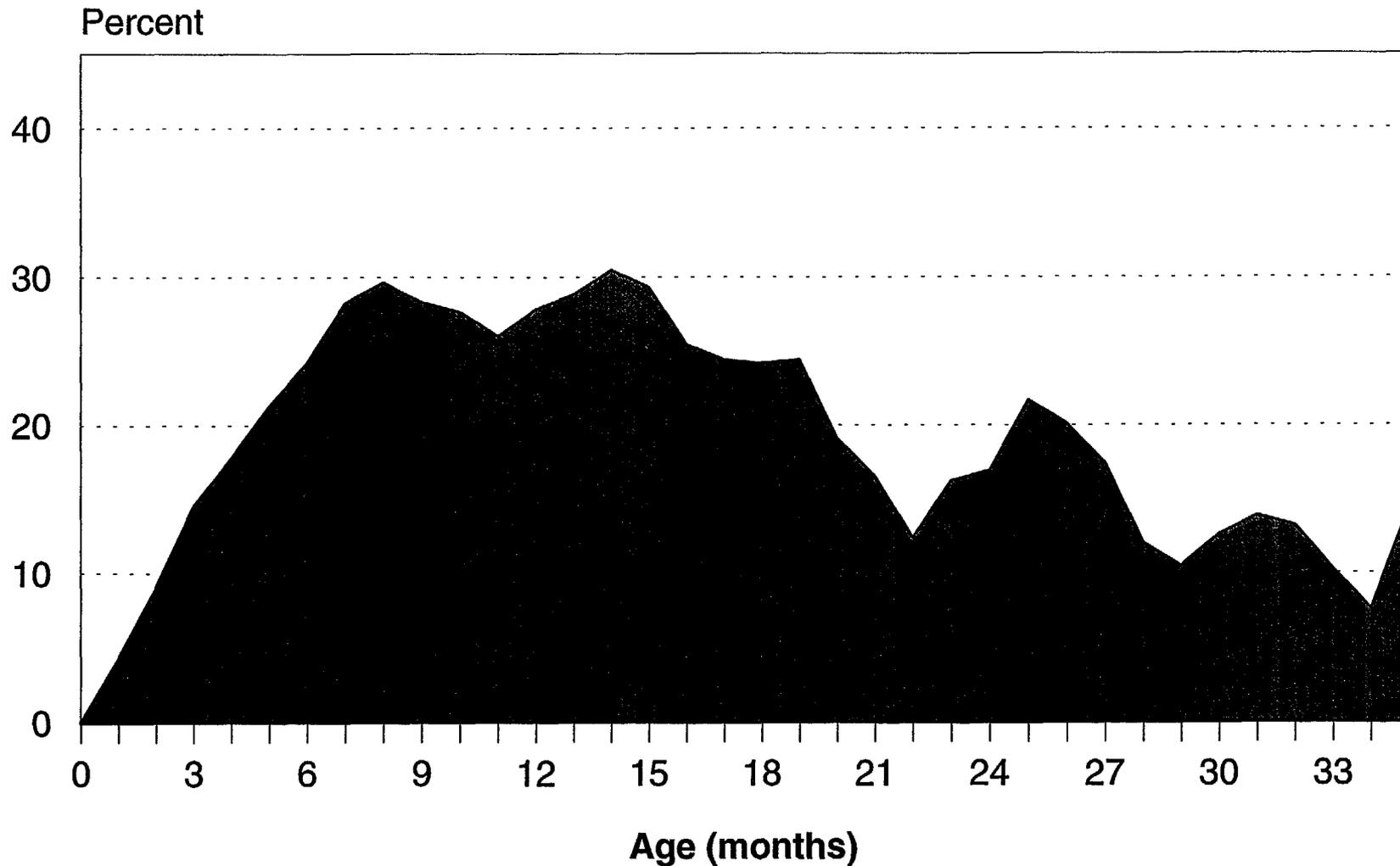
Figure 15: Age-related Pattern of Diarrhea among Children under 3 Years, Tanzania

In Tanzania:

- **Twenty percent of children under 3 years of age had diarrhea during the two weeks preceding the survey. The TDHS shows that the prevalence of diarrhea increases rapidly during infancy until it peaks at age 9 months, when nearly 30 percent of the children are reported to have had diarrhea during the preceding two weeks. The prevalence of diarrhea remains high through 15 months of life, after which it gradually declines to around 15 percent.**

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, once infants begin to crawl and move around, they tend to put objects into their mouth, again increasing the risk of pathogen contamination.

Figure 15
**Age-related Pattern of Diarrhea among Children
under 3 Years, Tanzania**



Source: TDHS 1996

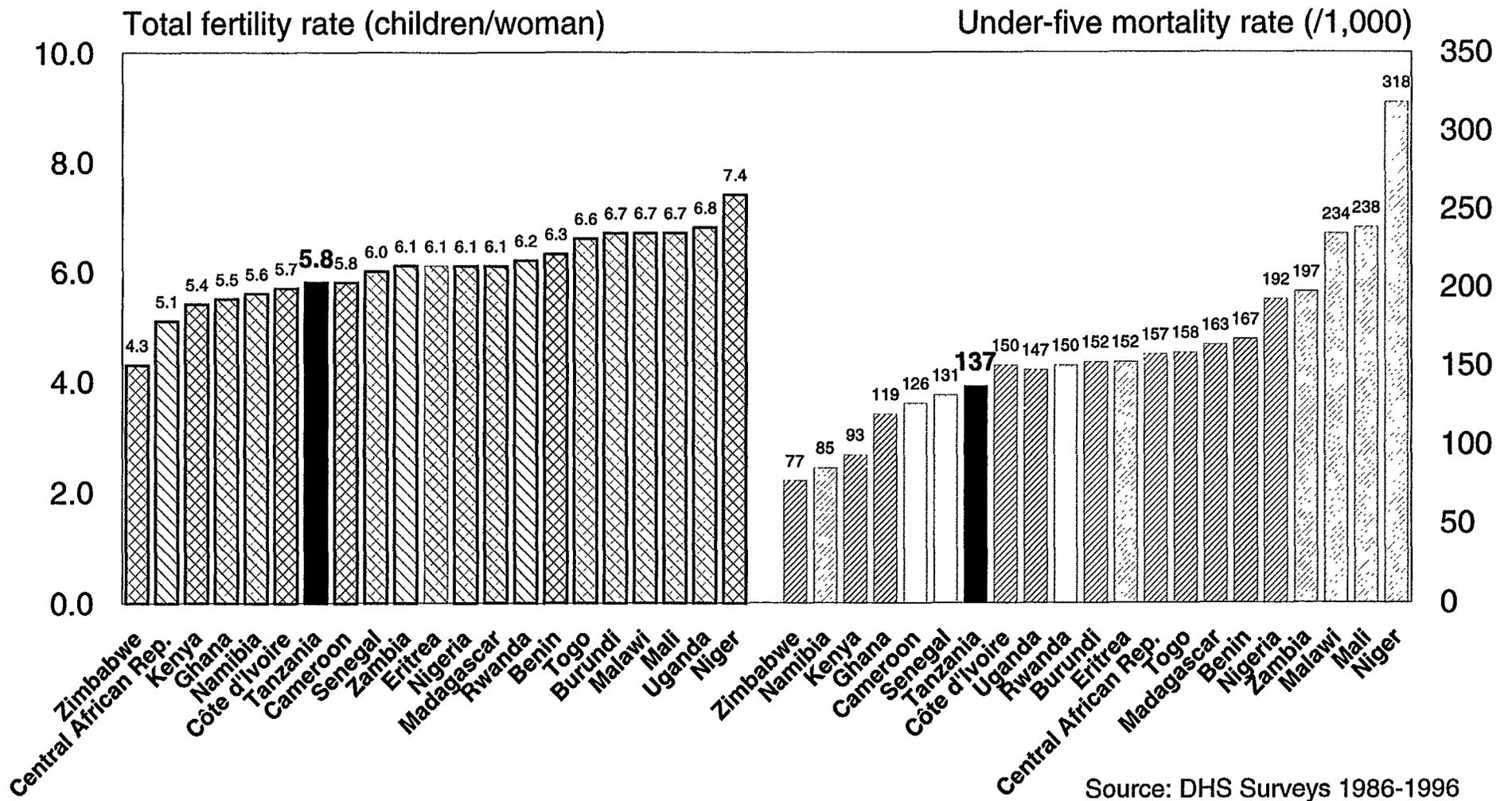
Figure 16: Fertility and Child Mortality in Tanzania Compared with Other Sub-Saharan Countries

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 malnutrition and disease, are more likely to die.

- **At current fertility levels, each woman in Tanzania will have an average of 5.8 children by the end of her childbearing years.** (This is the total fertility rate for women age 15 to 49 years.) This rate is in the middle range among the sub-Saharan countries surveyed and represents an 8 percent decline since the 1992 TDHS.
- **At current mortality levels, nearly 14 percent of children born in Tanzania will die before their fifth birthday.** Tanzania's under-five mortality rate of 137 deaths per 1,000 births is in the lower middle range among the sub-Saharan countries surveyed and represents a 12 percent decline since the 1992 TDHS.

Figure 16

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



Source: DHS Surveys 1986-1996

Figure 17: Survival and Nutritional Status of Children, Tanzania

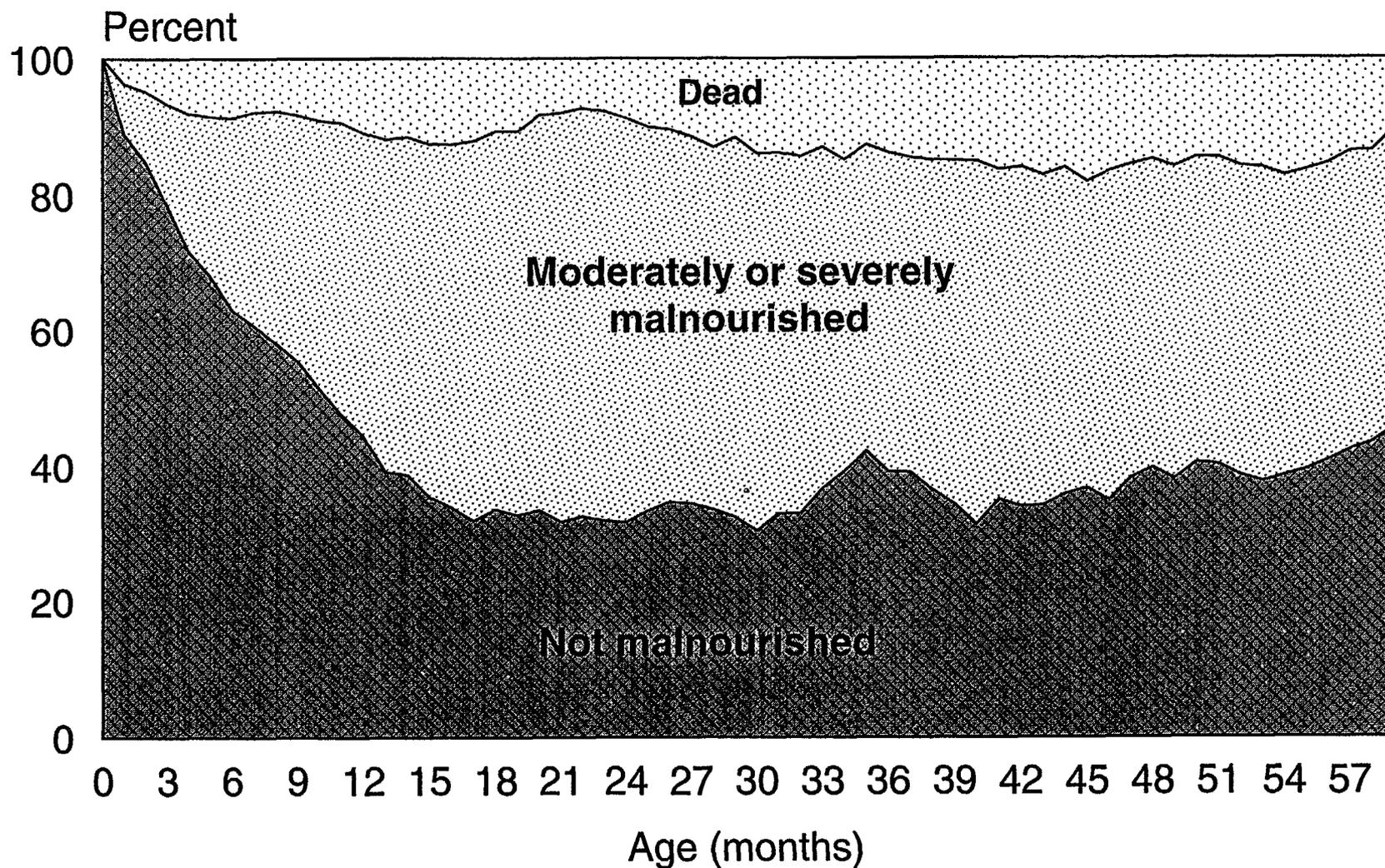
Malnutrition and mortality both take a tremendous toll on young children. This figure illustrates the proportion of children who have died or are malnourished at each age.

In Tanzania:

- During the first 17 months of life, the percentage of children who are alive and well nourished drops rapidly.
- **At the age of 18 months, 10 percent of children have died, 59 percent are severely or moderately malnourished,¹ and only 31 percent remain alive and well nourished.**

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

Figure 17
**Survival and Nutritional Status of Children,
 Tanzania**



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

Source: TDHS 1996

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Figure 18: Contribution of Malnutrition to Under-five Mortality, Tanzania

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

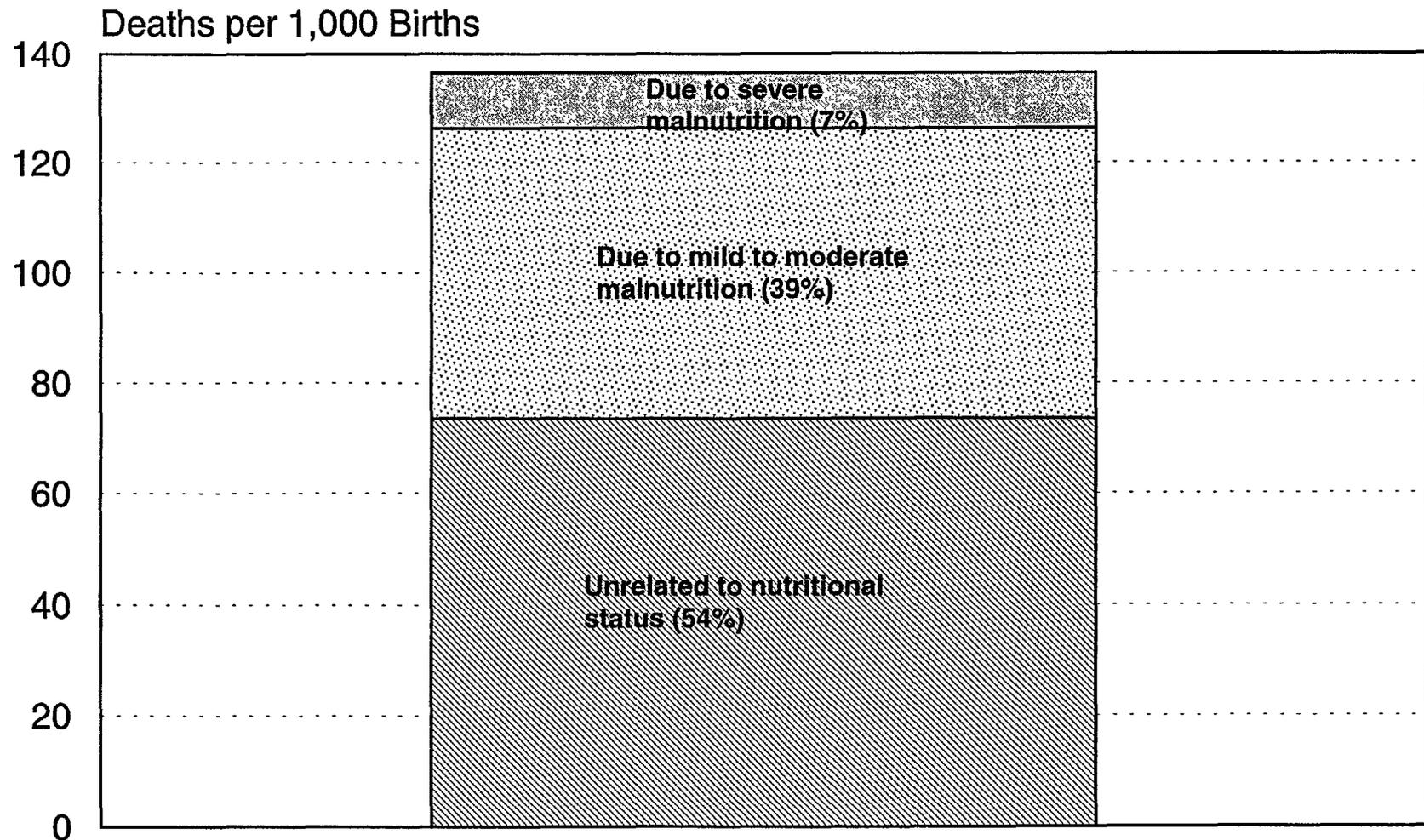
In Tanzania,

- **Sixty-three deaths per thousand births are related to malnutrition.** This is 46 percent of all deaths that occur before age five.
- **Because of its extensive prevalence, mild-to-moderate malnutrition contributes to more deaths (53 per 1,000) than does severe malnutrition (10 per 1,000).** Thus, mild-to-moderate malnutrition is implicated in 84 percent of all deaths associated with malnutrition.

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 18

Contribution of Malnutrition to Under-five Mortality, Tanzania



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

Source: TDHS 1996

Figure 19: Malnutrition among Mothers of Children under 5 Years by Region, Tanzania

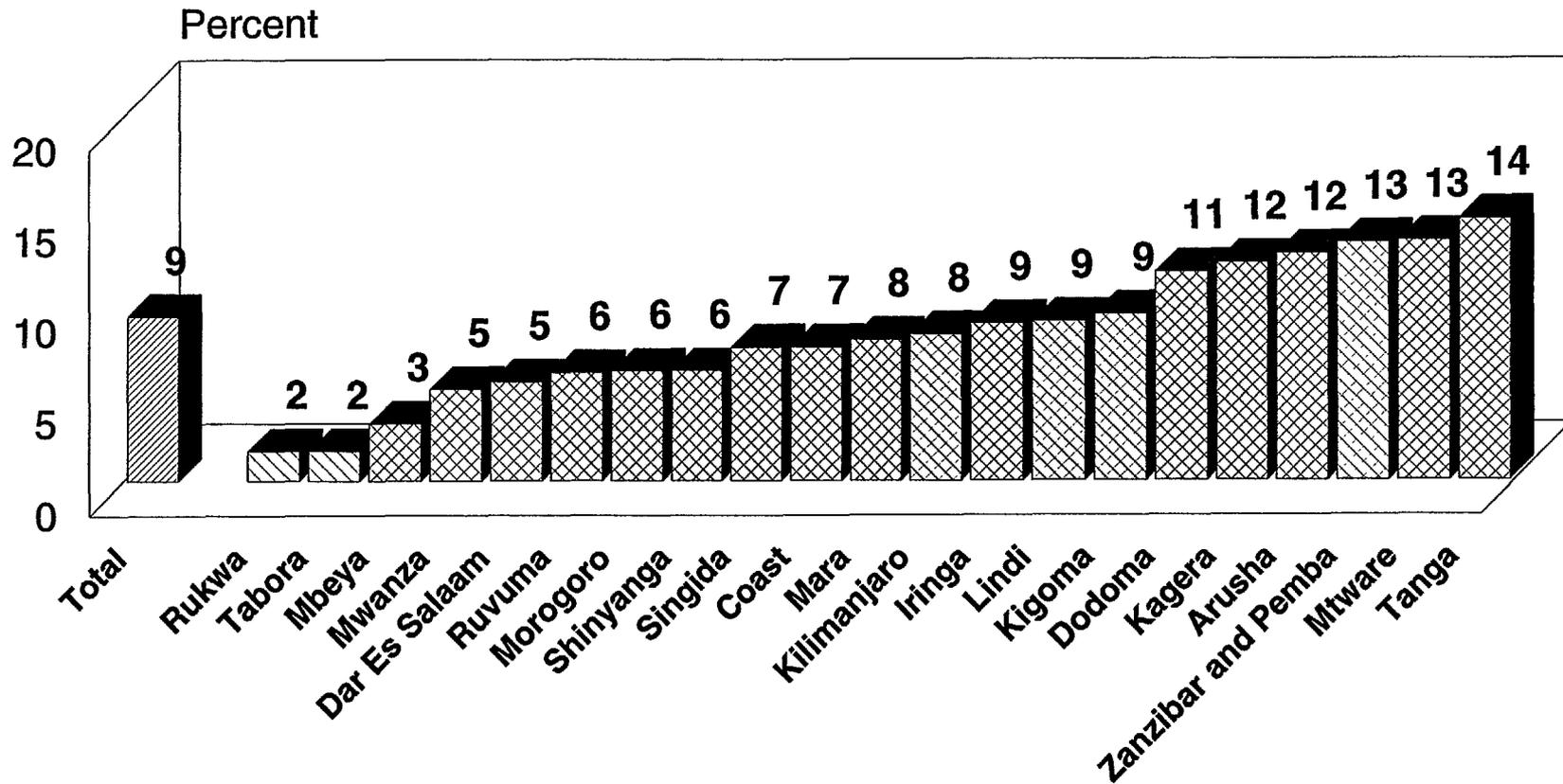
A mother's nutritional status affects her ability to successfully carry, deliver, and care for her children and is also of great concern in its own right. While there are no generally accepted cut-off points for indicators of malnutrition among adult women, ad-hoc standards can be applied.

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.

Malnutrition 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, $BMI = \text{kg}/\text{m}^2$. When the BMI falls below the suggested cut-off point of $18.5 \text{ kg}/\text{m}^2$, this indicates acute malnutrition for non-pregnant women.

- **Nine percent of mothers of children under age five in Tanzania are malnourished, while 3 percent are too short (not shown).**
- **Malnutrition and short stature did not vary between urban and rural areas or among different levels of maternal educational attainment. By region, the highest prevalence of maternal malnutrition occurs in Tanga (14 percent), and the highest prevalence of short stature occurs in Lindi where 10 percent of mothers are too short.**

Figure 19
**Malnutrition among Mothers of Children Under 5 Years
 by Region, Tanzania**



Note: Malnutrition levels are based on the percentages of mothers whose BMI is less than 18.5 kg/m².

Source: TDHS 1996

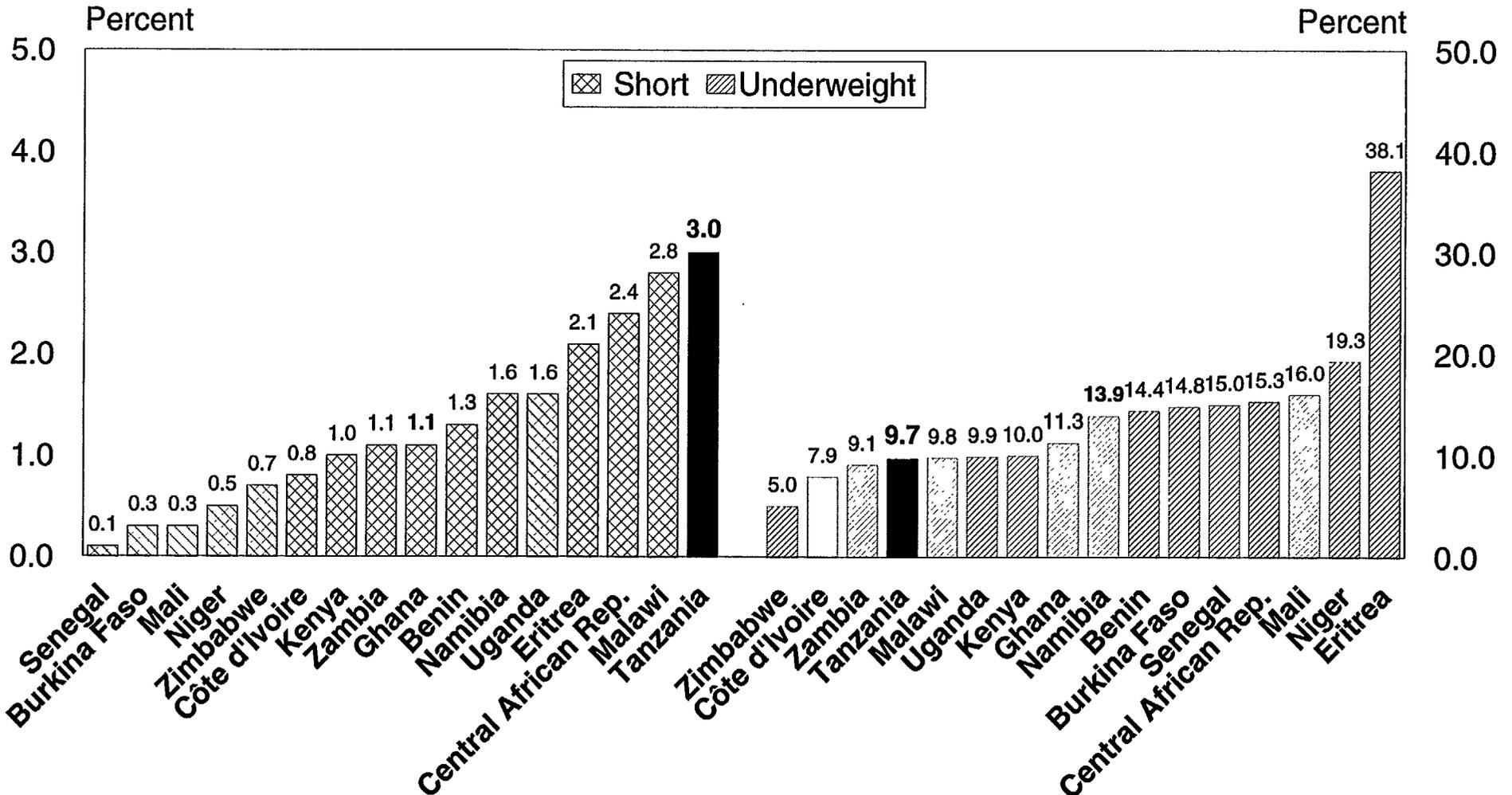
Figure 20: Malnutrition among Mothers of Children under 3 Years in Tanzania Compared with Other Sub-Saharan Countries

Malnutrition among mothers is likely to have a major impact on their ability to care for themselves and their born and unborn children.

- **Three percent of Tanzanian mothers of children under 3 years of age are too short.** This is the highest rate among the sub-Saharan countries surveyed.
- **Approximately 10 percent of mothers of children under 3 years of age are malnourished.** This is the fourth lowest rate reported for the sub-Saharan countries surveyed.

Figure 20

Malnutrition among Mothers of Children under 3 Years in Tanzania Compared with Other Sub-Saharan Countries



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

Source: DHS Surveys 1986-1996

Appendix 1

Stunting, Wasting and Underweight Rates by Background Characteristics Tanzania 1994

Background Characteristic	Stunted	Wasted	Under-weight	Background Characteristic	Stunted	Wasted	Under-weight
Child's Age in Months				Region of Residence			
0-5	10.7	5.5	7.0	Dodoma	48.1	8.1	34.8
6-11	27.2	6.9	27.2	Arusha	44.0	7.3	35.3
12-17	45.6	14.0	41.8	Kilimanjaro	33.3	5.7	21.1
18-23	59.5	13.3	40.5	Tanga	55.7	5.2	36.6
24-29	52.3	6.2	40.9	Morogoro	54.2	4.2	25.9
30-35	51.5	6.0	35.5	Coast	52.4	11.0	35.4
36-47	52.1	4.9	31.0	Dar es Salaam	30.6	8.5	23.1
48-59	47.4	4.6	26.7	Lindi	58.7	6.5	41.3
n=5344	P<0.0001	P<0.0001	P<0.0001	Mtware	58.0	5.7	36.2
Child's Sex				Ruvuma	54.2	5.4	29.6
male	42.1	6.6	30.6	Iringa	70.5	6.3	48.1
female	45.2	8.2	31.1	Mbeya	47.9	6.2	20.8
n=5344	P<.02	P<.03	NS	Singida	38.5	6.9	28.3
Location of Residence				Tabora	25.6	4.7	14.1
rural	46.1	7.3	33.2	Rukwa	42.4	9.8	31.0
urban	32.5	8.1	20.1	Kigoma	52.7	8.0	43.2
n=5443	P<0.0001	NS	P<0.0001	Shinyanga	31.7	7.2	28.1
				Kagera	42.0	11.7	36.0
				Mwanza	33.8	7.5	27.4
				Mara	32.7	8.5	19.0
				Zanzibar	48.0	11.2	35.1
				n=5344	p<0.0001	P<0.0004	P<0.0001

Note: Level of significance is determined using the chi-square test. NS = Not significant

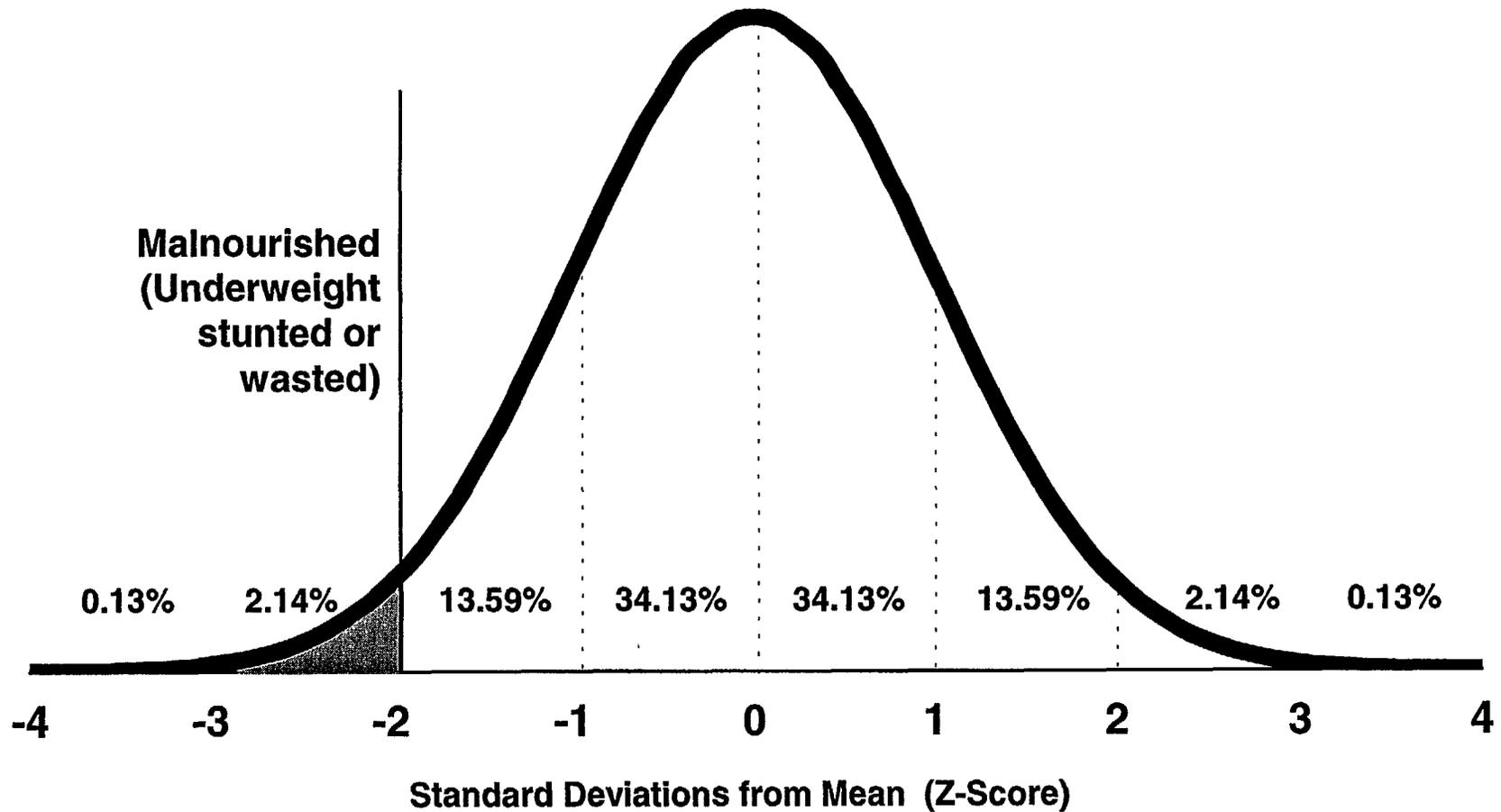
Appendix 2

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 malnourished. 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**



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