CHAPTER 7

NUTRITION AND THE PREVALENCE OF ANAEMIA

This chapter focuses on the nutrition of women and young children, examining both the types of food consumed and the consequences of inadequate nutrition and poor feeding practices. NFHS-1 included basic information about feeding practices and the nutritional status of young children. NFHS-2 contains more comprehensive information on these topics, and, for the first time, information on the diet of women. Measurement of height and weight has been expanded to include ever-married women as well as young children. Two additional tests have been included for the first time—anaemia testing for women and young children and the testing of cooking salt to determine the extent of iodization. A specially trained health investigator attached to each interviewing team conducted height and weight measurements and anaemia testing.

7.1   Women's Food Consumption

The consumption of a wide variety of nutritious foods is important for women's health. Adequate amounts of protein, fat, carbohydrates, vitamins, and minerals are required for a well-balanced diet. Meat, fish, eggs, and milk, as well as pulses and nuts, are rich in protein. Green, leafy vegetables are a rich source of iron, folic acid, vitamin C, carotene, riboflavin, and calcium. Many fruits are also good sources of vitamin C. Bananas are rich in carbohydrates. Papayas, mangoes, and other yellow fruits contain carotene, which is converted to vitamin A. Vitamin A is also present in milk and milk products, as well as egg yolks (Gopalan et al., 1996).

NFHS-2 asked ever-married women how often they consume various types of food (daily, weekly, occasionally, or never). Women consume vegetables (both green, leafy vegetables and other vegetables) most often (Table 7.1). A majority of women (71 percent) consume 'other' vegetables on a daily basis and 78 percent consume green, leafy vegetables either daily or at least once a week. Pulses and beans are also an important part of the diet for women. Forty-two percent of women eat pulses or beans every day, and another 53 percent eat pulses or beans weekly. Almost half of women (49 percent) in Tamil Nadu consume milk or curd every day. Fruits are eaten every day by only 12 percent of women, while 34 percent of women eat fruits weekly, and 53 percent of women eat fruits occasionally. More than half of women eat chicken, meat, or fish at least once a week and 43 percent of women consume these items occasionally. Only 5 percent of women never eat chicken, meat, or fish. Eggs are consumed about as often as chicken, meat, or fish.

Table 7.2 shows that there are substantial differentials in food consumption patterns by selected background characteristics. The consumption pattern of milk or curd, pulses or beans, and 'other' vegetables does not vary by age of women, whereas the consumption of green, leafy vegetables, fruits, eggs, and chicken, meat, or fish is slightly lower for the oldest age group of women. Women in urban areas are more likely than women in rural areas to include every type of food in their diet, particularly fruits, eggs, and chicken, meat, or fish. Women in Chennai are much more likely than women in other urban areas in Tamil Nadu to eat green, leafy vegetables, eggs, and chicken, meat, or fish. Illiterate women have poorer and less varied diets than literate women, and their diets are particularly deficient in such nutritious foods as fruits and milk/curd, as well as eggs, chicken, meat, or fish. Consumption of pulses/beans and 'other' vegetables does not vary much by education of women. Muslim women are more likely than Hindu or Christian women to consume

Table 7.1 Women's food consumption

Percent distribution of ever-married women by frequency of consumption of specific foods,
Tamil Nadu, 1999

	Frequency of consumption					Total percent
Type of food	Daily	Weekly	Occasionally	Never	Missing	
Milk or curd	48.7	17.8	30.1	3.4	0.0	100.0
Pulses or beans	41.9	52.7	5.4	0.1	0.0	100.0
Green, leafy vegetables	9.0	68.6	22.2	0.2	0.0	100.0
Other vegetables	71.4	27.3	1.3	0.0	0.0	100.0
Fruits	12.2	34.0	53.4	0.2	0.1	100.0
Eggs	5.3	47.4	41.8	5.5	0.1	100.0
Chicken, meat, or fish	2.5	50.0	42.8	4.6	0.0	100.0

Table 7.2 Women's food consumption by background characteristics

Percentage of ever-married women consuming specific foods at least once a week by selected background characteristics,
Tamil Nadu, 1999

	Type of food							Number of women
Background characteristic	Milk or curd	Pulses or beans	Green, leafy vegetables	Other vegetables	Fruits	Eggs	Chicken, meat, or fish	
Age								
15–24	65.9	95.0	80.1	98.8	48.3	56.8	56.1	1,018
25–34	66.9	95.2	78.4	99.2	47.8	55.4	54.7	1,789
35–49	66.4	93.7	75.5	98.2	43.6	47.8	48.6	1,869
Residence								
Urban	78.8	96.3	86.1	99.6	65.4	68.6	66.7	1,620
Rural	59.9	93.7	73.1	98.2	36.0	44.2	45.1	3,056
Chennai	77.9	98.9	92.6	99.5	68.2	78.3	79.1	289
Education								
Illiterate	51.1	93.0	70.4	98.0	31.3	39.7	42.5	2,221
Literate, < middle school complete	73.6	94.9	79.2	99.2	49.2	60.1	59.0	1,085
Middle school complete	79.3	97.2	85.2	99.6	57.5	65.4	61.8	629
High school complete and above	91.2	96.8	90.5	99.4	76.9	69.9	65.4	741
Religion								
Hindu	65.4	94.5	76.7	98.7	44.1	49.7	49.4	4,145
Muslim	77.5	97.2	85.3	99.9	63.5	79.8	81.8	277
Christian	72.3	93.1	83.9	99.0	61.7	71.4	75.5	242
Caste/tribe								
Scheduled caste	51.1	94.6	70.8	98.6	33.5	45.5	53.1	1,089
Scheduled tribe	(15.5)	(87.7)	(78.5)	(81.5)	(34.8)	(22.2)	(31.5)	39
Other backward class	71.2	94.6	79.4	98.9	49.4	55.7	53.2	3,469
Other	94.0	97.8	95.1	100.0	88.6	34.6	26.4	79
Standard of living index								
Low	45.5	91.7	68.8	97.6	27.3	38.0	41.2	1,756
Medium	74.5	96.1	80.3	99.3	50.1	57.8	56.3	2,168
High	93.6	97.1	91.2	99.6	81.0	73.9	69.1	704
Total	66.5	94.6	77.6	98.7	46.2	52.7	52.6	4,676

Note: Total includes 7 women belonging to other religions and 6, 1, and 48 women with missing information on religion, caste/tribe, and the standard of living index, respectively, who are not shown separately.
( ) Based on 25–49 unweighted cases

every type of food item at least once a week. Women from scheduled castes, scheduled tribes, and other backward classes have a relatively poor diet that is particularly deficient in fruits, milk/curd, and green, leafy vegetables. However, women who do not belong to a scheduled caste, scheduled tribe, or other backward class are far less likely to eat eggs and chicken, meat or fish. Scheduled caste women are less likely to consume milk or curd, green, leafy vegetables, fruits and eggs than women from other backward classes. As expected, standard of living has a strong negative effect on the consumption of nutritious types of food. Women in households with a low standard of living are much less likely than other women to eat fruits, milk or curd, green, leafy vegetables, eggs, and chicken, meat, or fish on a weekly basis.

7.2 Nutritional Status of Women

In NFHS-2, ever-married women age 15–49 were weighed using a solar-powered digital scale with an accuracy of ±100 grams. Their height was measured using an adjustable wooden measuring board specially designed to provide accurate measurements (to the nearest 0.1 cm) of women and children in a field situation. The weight and height data were used to calculate several indicators of women's nutritional status, which are shown in Table 7.3. The height of an adult is an outcome of several factors including nutrition during childhood and adolescence. A woman's height can be used to identify women at risk of having a difficult delivery, since small stature is often related to small pelvic size. The risk of having a baby with a low birth weight is also higher for mothers who are short.

The cutoff point for height, below which a woman can be identified as nutritionally at risk, varies among populations, but it is usually considered to be in the range of 140–150 centimetres (cm). NFHS-2 found a mean height for women in Tamil Nadu of 152 cm (about the same as for women in India as a whole). The mean height varies only slightly (between 150 and 153 cm) for women in different population groups, as shown in Table 7.3. Christian women are, on average, 1–2 cm taller than Muslim and Hindu women, and women who do not belong to a scheduled caste, scheduled tribe, or other backward class are 2–4 cm taller than women who belong to these castes and tribes. As expected, both education and standard of living are positively related to height of women. Twelve percent of women in Tamil Nadu are under 145 cm in height. The highest percentage of women in any group who are less than 145 cm tall is 16 percent for scheduled caste women.

Table 7.3 also shows two measures of an index that relates a woman's weight to her height. The index excludes women who were pregnant at the time of the survey and women who gave birth during the two months preceding the survey. The body mass index (BMI) can be used to assess both thinness and obesity. The BMI is defined as the weight in kilograms divided by the height in metres squared (kg/m^2). The mean BMI for women in Tamil Nadu is 21 (varying within a narrow range of 19–24 for all the groups shown in the table). The mean for Tamil Nadu is just above the level of 20 for India as a whole. Chronic energy deficiency is usually indicated by a BMI of less than 18.5. Twenty-nine percent of women in Tamil Nadu have a BMI below 18.5 (compared with 36 percent for all of India), indicating a moderate prevalence of nutritional deficiency. Undernutrition, as indicated by a BMI under 18.5, is particularly serious for rural women, women age 15–24, ever-married women who are not currently married, illiterate women, women from scheduled tribes and scheduled castes, and women employed by someone else or working on a family farm or in a family business. The standard of living is particularly strongly related to chronic energy deficiency. Women from households with a low standard of living (40 percent) are four times more likely to

Table 7.3 Nutritional status of women

Among ever-married women, mean height, percentage with height below 145 cm, mean body mass index (BMI), and percentage with BMI below 18.5 kg/m^2 by selected background characteristics, Tamil Nadu, 1999

	Height			Weight-for-height[1]		
Background characteristic	Mean height (cm)	Percentage below 145 cm	Number of women for height	Mean body mass index (BMI)	Percentage with BMI below 18.5 kg/m^2	Number of women for BMI
Age						
15–19	151.9	7.9	243	19.7	37.8	205
20–24	151.6	11.1	760	19.9	36.6	652
25–29	151.9	10.3	946	20.6	30.1	867
30–34	151.7	10.5	819	21.2	27.7	799
35–49	151.0	14.4	1,850	21.5	25.4	1,839
Marital status						
Currently married	151.6	11.7	4,197	21.0	28.6	3,943
Not currently married	150.6	14.7	420	20.4	33.2	418
Residence						
Urban	151.5	12.6	1,600	22.4	17.5	1,527
Rural	151.5	11.6	3,017	20.2	35.2	2,834
Chennai	151.9	10.2	284	22.7	15.7	272
Education						
Illiterate	150.7	14.9	2,186	19.9	37.2	2,086
Literate, < middle school complete	151.6	10.1	1,074	21.5	24.5	1,003
Middle school complete	152.0	10.3	624	21.7	22.6	593
High school complete and above	153.2	7.4	732	22.6	16.2	679
Religion						
Hindu	151.4	12.1	4,094	20.8	30.3	3,860
Muslim	151.2	13.9	270	23.1	15.9	260
Christian	152.7	8.9	240	22.0	20.8	230
Caste/tribe						
Scheduled caste	150.6	15.5	1,075	19.8	38.1	1,008
Scheduled tribe	(149.5)	(12.7)	38	(18.5)	(56.1)	36
Other backward class	151.7	11.0	3,424	21.3	26.3	3,241
Other	153.2	5.8	79	23.1	12.4	75
Work status						
Working in family farm/business	152.0	9.8	481	20.3	33.2	455
Employed by someone else	151.0	14.0	1,806	19.9	36.1	1,742
Self-employed	151.0	15.4	191	22.1	24.7	184
Not worked in past 12 months	151.8	10.4	2,139	21.9	22.2	1,981
Standard of living index						
Low	150.5	14.7	1,726	19.5	40.2	1,635
Medium	151.8	10.9	2,150	21.2	26.4	2,017
High	153.0	8.2	695	23.9	9.0	665
Total	151.5	12.0	4,617	21.0	29.0	4,361

Note: Total includes a small number of women belonging to other religions and women with missing information on religion, caste/tribe, and the standard of living index, who are not shown separately.
( ) Based on 25–49 unweighted cases
[1]Excludes women who are pregnant and women with a birth in the preceding two months. The body mass index (BMI) is the ratio of the weight in kilograms to the square of the height in metres (kg/m^2).

have a low BMI than women from households with a high standard of living (9 percent). The proportion of women with a BMI below 18.5 is higher for Hindus (30 percent) than Christians (21 percent) or Muslims (16 percent).

7.3   Anaemia Among Women

Anaemia is characterized by a low level of haemoglobin in the blood. Haemoglobin is necessary for transporting oxygen from the lungs to other tissues and organs of the body. Anaemia usually results from a nutritional deficiency of iron, folate, vitamin B_{12}, or some other nutrients. This type of anaemia is commonly referred to as iron-deficiency anaemia. Iron deficiency is the most widespread form of malnutrition in the world, affecting more than two billion people (Stolzfus and Dreyfuss, 1998). In India, anaemia affects an estimated 50 percent of the population (Seshadri, 1998).

Anaemia may have detrimental effects on the health of women and children and may become an underlying cause of maternal mortality and perinatal mortality. Anaemia results in an increased risk of premature delivery and low birth weight (Seshadri, 1997). Early detection of anaemia can help to prevent complications related to pregnancy and delivery as well as child-development problems. Information on the prevalence of anaemia can be useful for the development of health-intervention programmes designed to prevent anaemia, such as iron-fortification programmes.

In India, under the Government's Reproductive and Child Health Programme, iron and folic acid tablets are provided to pregnant women in order to prevent anaemia during pregnancy. Because anaemia is such a serious health problem in India, NFHS-2 undertook direct measurement of the haemoglobin levels of all ever-married women age 15–49 years and their children under three years of age. Measurements were taken in the field using the HemoCue system.[1] This system uses a single drop of blood from a finger prick (or a heel prick in the case of infants under six months old), which is drawn into a cuvette and then inserted into a portable, battery-operated instrument.[2] In less than one minute, the haemoglobin concentration is indicated on a digital read-out.

Before the anaemia testing was undertaken in a household, the health investigator read a detailed informed consent statement to the respondent, informing her about anaemia, describing the procedure to be followed for the test, and emphasizing the voluntary nature of the test. She was then asked whether or not she would consent to have the test done for herself and her young children, if any. The health investigator then signed the questionnaire at the bottom of the statement to indicate that it had been read to the respondent and recorded her agreement or lack of agreement to the testing. If the test was conducted, at the end of the test the respondent was given a written record of the results for herself and each of her young children. In addition, the health investigator described to her the meaning of the results and advised her if medical

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[1]The HemoCue instrument has been used extensively throughout the world for estimating the concentration of haemoglobin in capillary blood in field situations. The HemoCue has been found to give accurate results on venous blood samples, comparable to estimates from more sophisticated laboratory instruments (Von Schenk et al., 1986; McNulty et al., 1995; Krenzicheck and Tanseco, 1996). A recent small–scale study in India (Prakash et al., 1999), however, found that the HemoCue provided slightly higher estimates of haemoglobin than the standard blood cell counter (BCC) method.

[2]Because the first 2–3 drops of blood are wiped away to be sure that the sample used for analysis consists of fresh capillary blood, it is actually the third or fourth drop of blood that is drawn into the cuvette.

treatment was necessary. In cases of severe anaemia, the respondent was read an additional statement asking whether or not she would give her permission for the survey organization to inform a local health official about the problem. For each Primary Sampling Unit, a local health official was given a list of severely anaemic women (and children) who had consented to the referral.

Table 7.4 and Figure 7.1 show anaemia levels for ever-married women age 15–49. The table and figure distinguish three levels of severity of anaemia: mild anaemia (10.0–10.9 grams/decilitre for pregnant women and 10.0–11.9 g/dl for non-pregnant women), moderate anaemia (7.0–9.9 g/dl), and severe anaemia (less than 7.0 g/dl). Appropriate adjustments in these cutoff points were made for women living at altitudes above 1,000 metres and women who smoke, since both of these groups require more haemoglobin in their blood (Centers for Disease Control and Prevention, 1998).

In Tamil Nadu, the haemoglobin levels were tested for 98 percent of women (see Table B.3 in Appendix B), compared with 88 percent of women in India as a whole. Overall, 57 percent of women have some degree of anaemia[3] (compared with 52 percent for all India). Thirty-seven percent of women are mildly anaemic, 16 percent are moderately anaemic, and 4 percent are severely anaemic. These levels are slightly higher than those for all of India: 35 percent mildly anaemic, 15 percent moderately anaemic, and 2 percent severely anaemic. There are differences in the prevalence of anaemia by background characteristics, but anaemia is substantial for women in every population group. Prevalence is slightly higher for younger women less than age 25 than for older women. It is higher for rural women (59 percent) than for urban women (52 percent), and it is also higher for ever-married women who are not currently married (65 percent) than currently married women (56 percent).

The prevalence of anaemia is much higher for women belonging to scheduled castes or scheduled tribes, illiterate women, women employed by someone else, and women with a low standard of living than for those in other groups. The prevalence of anaemia is much higher for Muslims (59 percent) and Hindus (57 percent) than Christians (48 percent).

The prevalence of anaemia is higher for breastfeeding women than for other groups, but there is little difference in the prevalence of anaemia between pregnant women and non-regnant women who are not breastfeeding. Since anaemia is often considered to be particularly problematic for pregnant women, it is noteworthy that these women do not have significantly higher levels of anaemia than non-pregnant women. The provision of iron and folic acid supplements to pregnant women has undoubtedly reduced the overall prevalence of anaemia in pregnant women to some extent (women received IFA tablets or syrup during pregnancy for 93 percent of births in the three years before the survey—see Table 8.5). However, by far the

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[3]Rates that are not adjusted for altitude and smoking (55.5 percent for any anaemia, 37.0 percent for mild anaemia, 15.8 percent for moderate anaemia, and 2.6 percent for severe anaemia) are slightly lower than the corresponding adjusted rates for 'any anaemia' and 'severe anaemia'. The small impact of the adjustment factor is to be expected since, in Tamil Nadu, the proportion of women who smoke is very small (see Table 2.12), and only 3 of the 158 sample PSUs are at an altitude above 1,000 metres.

Table 7.4 Anaemia among women

Percentage of ever-married women classified as having iron-deficiency anaemia by degree of anaemia, according to selected background characteristics, Tamil Nadu, 1999

| Background characteristic	Percentage of women with any anaemia	Percentage of women with:			Number of women
		Mild anaemia	Moderate anaemia	Severe anaemia	
Age					
15–19	59.5	36.8	20.7	1.9	243
20–24	59.0	37.3	18.2	3.5	755
25–29	57.2	36.4	16.5	4.3	940
30–34	51.9	34.8	13.0	4.1	817
35–49	56.7	37.5	15.2	4.0	1,837
Marital status					
Currently married	55.6	36.4	15.5	3.8	4,176
Not currently married	65.3	40.2	19.9	5.2	415
Residence					
Urban	51.6	35.7	12.3	3.6	1,591
Rural	59.1	37.3	17.8	4.1	3,000
Chennai	54.7	40.3	13.6	0.8	284
Education					
Illiterate	62.0	39.2	18.3	4.5	2,171
Literate, < middle school complete	53.2	34.9	14.2	4.1	1,072
Middle school complete	54.8	34.8	16.7	3.4	621
High school complete and above	46.1	33.4	10.4	2.3	727
Religion					
Hindu	56.8	37.1	15.8	3.8	4,071
Muslim	59.3	35.7	18.1	5.5	270
Christian	48.0	31.0	13.5	3.5	237
Caste/tribe					
Scheduled caste	64.2	41.4	18.9	3.9	1,070
Scheduled tribe	(61.4)	(42.2)	(19.2)	(0.0)	38
Other backward class	54.2	35.2	15.0	4.0	3,404
Other	49.4	35.7	13.3	0.4	79
Work status					
Working in family farm/business	53.3	37.2	13.4	2.8	482
Employed by someone else	60.0	38.2	17.6	4.2	1,797
Self-employed	51.3	28.8	14.1	8.4	189
Not worked in past 12 months	54.7	36.1	15.1	3.5	2,123
Standard of living Index					
Low	65.1	39.8	20.3	5.1	1,716
Medium	52.6	34.6	14.5	3.5	2,141
High	46.9	35.4	9.4	2.1	688
Pregnancy/breastfeeding status					
Pregnant	57.1	25.5	27.1	4.6	310
Breastfeeding (not pregnant)	61.6	38.7	19.3	3.5	607
Not pregnant/not breastfeeding	55.6	37.3	14.4	3.9	3,674
Height					
< 145 cm	60.8	35.5	18.6	6.7	562
≥ 145 cm	55.9	36.9	15.5	3.5	4,027

Table 7.4 Anaemia among women (contd.)

Percentage of ever-married women classified as having iron-deficiency anaemia by degree of anaemia, according to selected background characteristics, Tamil Nadu, 1999

Background characteristic	Percentage of women with any anaemia	Percentage of women with:			Number of women
		Mild anaemia	Moderate anaemia	Severe anaemia	
Body mass index					
< 18.5 kg/m^2	63.8	38.1	19.5	6.2	1,291
≥ 18.5 kg/m^2	53.7	36.2	14.5	3.0	3,286
Fruit and vegetable consumption[1]					
Fruits and vegetables	53.2	36.2	13.9	3.1	1,885
Fruits only	51.6	37.7	11.0	2.9	242
Vegetables only	58.8	36.3	18.1	4.5	1,686
Neither	60.8	38.5	17.4	4.8	776
Total	56.5	36.7	15.9	3.9	4,591

Note: The haemoglobin levels are adjusted for altitude of the enumeration area and for smoking when calculating the degree of anaemia. Total includes 7 women belonging to other religions and 6, 1, 45, 2, 14, and 2 women with missing information on religion, caste/tribe, the standard of living index, height, body mass index, and fruit and vegetable consumption, respectively, who are not shown separately.
( ) Based on 25–49 unweighted cases
[1]Based on consumption at least weekly. Vegetables include only green, leafy vegetables.

Figure 7.1
Anaemia Among Women

NFHS-2, Tamil Nadu, 1999
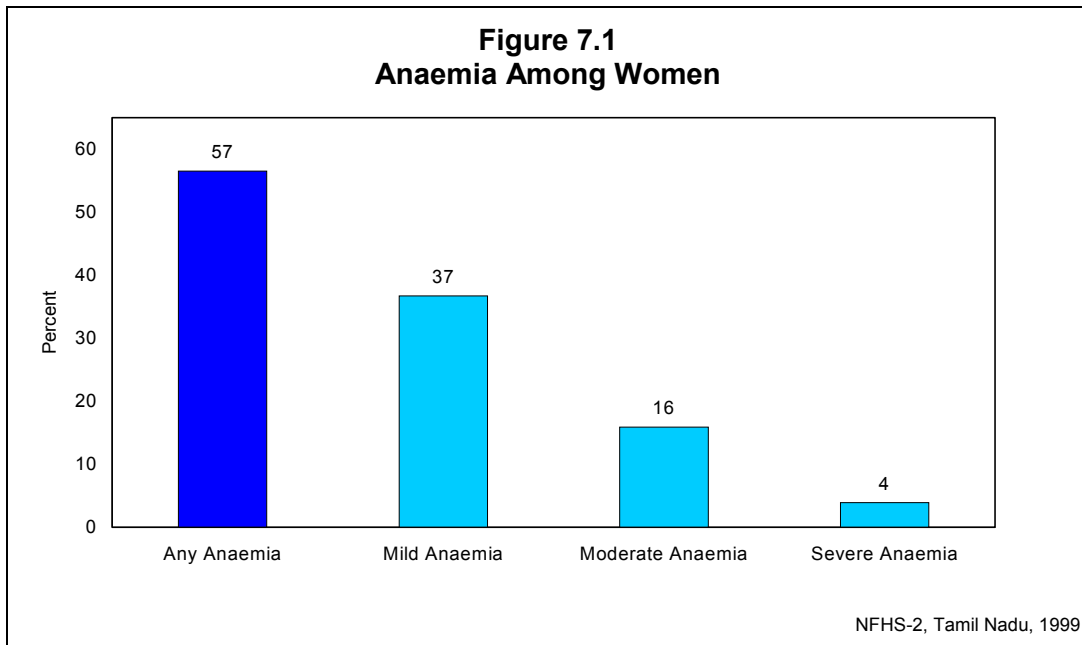
highest levels of moderate or severe anaemia are experienced by pregnant women (32 percent compared with 23 percent for breastfeeding women and 18 percent for nonpregnant, nonbreastfeeding women).

Shorter women and women with a low body mass index have a higher prevalence of anaemia than other women. The diet of women also plays a role in the likelihood that they have anaemia. Consumption of iron-rich foods can reduce the prevalence or severity of anaemia, and the absorption of iron from the diet can be enhanced (for example, by vitamin C) or inhibited (for

example, by tea or coffee) if particular items are consumed around the time that a meal is eaten. In Tamil Nadu, differentials in anaemia by fruit and vegetable consumption are large. Women who eat fruit (alone or in addition to green, leafy vegetables) at least weekly have a lower level of anaemia (52–53 percent) than women who do not eat fruit regularly (59–61 percent). Women who do not eat either fruit or green, leafy vegetables at least once a week are the most likely to have anaemia (61 percent).

7.4   Infant Feeding Practices

Infant feeding practices have significant effects on both mothers and children. Mothers are affected through the influence of breastfeeding on the period of postpartum infertility, and hence on fertility levels and the length of birth intervals. These effects vary by both the duration and intensity of breastfeeding. Proper infant feeding, starting from the time of birth, is important for the physical and mental development of the child. Breastfeeding improves the nutritional status of young children and reduces morbidity and mortality. Breast milk not only provides important nutrients but also protects the child against infection. The timing and type of supplementary foods introduced in an infant's diet also have significant effects on the child's nutritional status.

The Baby Friendly Hospitals Initiative, launched by the United Nations Children's Fund (UNICEF), recommends initiation of breastfeeding immediately after childbirth. The World Health Organization (WHO) and UNICEF recommend that infants should be given only breast milk for about the first six months of their life. Under the Reproductive and Child Health Programme, the Government of India recommends that infants should be exclusively breastfed from birth to age four months (Ministry of Health and Family Welfare, n.d.). Most babies do not require any other foods or liquids during this period. By age seven months, adequate and appropriate complementary foods should be added to the infant's diet in order to provide sufficient nutrients for optimal growth. It is recommended that breastfeeding should continue, along with complementary foods, through the second year of life or beyond. It is further recommended that a feeding bottle with a nipple should not be used at any age, for reasons related mainly to sanitation and the prevention of infections.

WHO has suggested several indicators of breastfeeding practices to guide countries in gathering information for measuring and evaluating infant feeding practices. These indicators include the ever breastfed rate, the exclusive breastfeeding rate, the timely complementary feeding rate, the continued breastfeeding rate, and the bottle feeding rate. The *exclusive breastfeeding rate* is defined as the proportion of infants under age four months who receive only breast milk.[4] The *timely complementary feeding rate* is the proportion of infants age 6–9 months who receive both breast milk and solid or semi-solid food. The *continued breastfeeding rate through one year of age* is the proportion of children age 12–15 months who are still breastfed. The *continued breastfeeding rate until two years of age* is the proportion of children age 20–23 months who are still breastfed. The *bottle feeding rate* is the proportion of infants who are fed using a bottle with a nipple.

In NFHS-2 in Tamil Nadu, data on breastfeeding and complementary feeding were obtained from a series of questions in the Woman's Questionnaire. These questions pertain to births since January 1996, but the tables are restricted to children born in the three years preceding the survey. For any given woman, information was obtained for a maximum of two births.

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[4]International recommendations have recently been revised to promote exclusive breastfeeding up to six months of age.

Initiation of breastfeeding immediately after childbirth is important because it benefits both the mother and the infant. As soon as the infant starts suckling at the breast, the hormone oxytocin is released, resulting in uterine contractions that facilitate expulsion of the placenta and reduce the risk of postpartum haemorrhage. It is also recommended that the first breast milk (colostrum) should be given to the child rather than squeezed from the breast and discarded, because it contains colostrum, which provides natural immunity to the child.

Table 7.5 shows the percentage of children born during the three years before the survey who started breastfeeding within one hour and one day of birth. It also gives the percentage of children whose mothers squeezed the first milk from the breast before breastfeeding, which is not recommended. Breastfeeding is nearly universal in Tamil Nadu. Half of children begin breastfeeding within one hour of birth (compared with 16 percent for all of India), and 79 percent begin breastfeeding within one day of birth (compared with 37 percent for India as a whole). One out of every five women (22 percent) who gave birth to children during the three years preceding the survey squeezed the first milk from the breast before they began breastfeeding (compared with 63 percent for all of India).

Differentials in the early initiation of breastfeeding and in squeezing the first milk from the breast are also shown in Table 7.5. Early initiation of breastfeeding does not vary much by residence, mother's education, mother's work status, and the standard of living. Hindu children are somewhat less likely than Muslim and Christian children to be put to the breast within the first hour of life. Early initiation of breastfeeding is higher among women from scheduled castes than among other women. The circumstances surrounding delivery of the baby can have an important effect on the early initiation of breastfeeding. Children whose delivery was assisted by a health professional, as well as children born in public health facilities, tend to begin breastfeeding relatively early.

The custom of squeezing the first milk from the breast before breastfeeding a child is more common among women in rural areas, illiterate women, Hindu women, women employed by someone else, and women with a low standard of living. Children whose delivery was assisted by someone other than a health professional and those born at home are particularly likely not to receive the first breast milk.

Mothers of children born in the three years preceding the survey were asked if the child had been given plain water, other liquids, or solid or mushy (semi-solid) food at any time during the day or night before the interview. Results are shown in Tables 7.6 and 7.7. Children who received nothing but breast milk during that period are defined as being *exclusively breastfed*. The introduction of supplementary foods before four months of age may put infants at risk of malnutrition because other liquids and solid foods are nutritionally inferior to breast milk. Consumption of liquids and solid or mushy foods at an early age also increases children's exposure to pathogens and consequently puts them at a greater risk of getting diarrhoea. However, a recent study based on findings from NFHS-1 (Anandaiah and Choe, 2000) concluded that breastfeeding with supplements is more beneficial than exclusive breastfeeding even for children at very young ages (less than four months). That report suggests that mothers who are not well nourished and who are in poor health themselves may not be able to provide adequate breast milk for their infants.

In Tamil Nadu, 48 percent of children under four months of age are exclusively breastfed (compared with 55 percent for India as a whole), 24 percent receive breast milk plus water, and 24

Table 7.5 Initiation of breastfeeding

Percentage of children born during the three years preceding the survey who started breastfeeding within one hour and within one day of birth and percentage whose mother squeezed the first milk from her breast before breastfeeding by selected background characteristics, Tamil Nadu, 1999

Background characteristic	Percentage started breastfeeding within one hour of birth	Percentage started breastfeeding within one day of birth[1]	Percentage whose mother squeezed first milk from breast	Number of children
Residence				
Urban	49.8	82.1	17.3	467
Rural	50.6	77.0	23.7	892
Chennai	45.4	80.5	21.5	78
Mother's education				
Illiterate	49.8	75.0	27.3	518
Literate, < middle school complete	51.3	83.0	20.5	329
Middle school complete	48.3	80.3	16.5	246
High school complete and above	51.9	79.3	16.0	266
Religion				
Hindu	49.2	78.6	22.8	1,179
Muslim	57.1	79.2	13.1	99
Christian	57.5	80.8	11.3	76
Caste/tribe				
Scheduled caste	57.7	79.4	20.3	337
Other backward class	48.2	78.9	21.9	994
Other[2]	(38.6)	(60.2)	(15.0)	19
Mother's work status				
Working in family farm/business	47.6	77.7	22.2	96
Employed by someone else	50.5	74.8	26.8	359
Self-employed	(35.7)	(75.2)	(17.8)	30
Not worked in past 12 months	51.1	80.6	19.3	875
Standard of living index				
Low	50.5	78.4	24.6	527
Medium	50.5	79.7	19.7	631
High	46.0	74.0	18.3	183
Assistance during delivery				
Health professional[3]	51.5	81.3	18.9	1,139
Dai (TBA)	45.4	71.1	29.0	135
Other	42.7	56.5	44.5	86
Place of delivery				
Public health facility	59.2	88.4	16.1	520
Private health facility	44.6	75.2	21.2	543
Own home	51.0	68.5	30.2	177
Parents' home	42.4	67.4	34.1	95
Total	50.3	78.7	21.5	1,359

Note: Table includes only the two most recent births during the three years preceding the survey, whether living or dead at the time of interview. Total includes 3 children belonging to other religions, 9 scheduled-tribe children, 16 children delivered in nongovernmental organization or trust hospitals/clinics, 9 children delivered at 'other' places, and 2 and 18 children with missing information on religion and the standard of living index, respectively, who are not shown separately.
TBA: Traditional birth attendant
( ) Based on 25–49 unweighted cases
[1]Includes children who started breastfeeding within one hour of birth
[2]Not belonging to a scheduled caste, a scheduled tribe, or an other backward class
[3]Includes doctor, auxiliary nurse midwife, nurse, midwife, lady health visitor, and other health professionals

Table 7.6 Breastfeeding status by child's age

Percent distribution of children under age 3 years by breastfeeding status, according to child's age in months, Tamil Nadu, 1999

| | Breastfeeding status | | | | | | |
| | | Breastfeeding and: | | | | | |
Age in months	Not breastfeeding	Exclusively breastfeeding	Receiving plain water only	Receiving supplements	Don't know if fed supplements	Total percent	Number of living children
< 2	1.8	69.9	16.5	11.8	0.0	100.0	61
2–3	5.9	26.3	31.6	36.2	0.0	100.0	60
4–5	1.6	17.6	28.7	52.1	0.0	100.0	75
6–7	9.1	8.7	10.8	71.3	0.0	100.0	68
8–9	33.1	1.7	1.8	63.4	0.0	100.0	66
10–11	17.9	0.0	2.7	79.4	0.0	100.0	99
12–13	24.1	0.0	0.0	75.9	0.0	100.0	83
14–15	39.2	0.0	0.0	60.8	0.0	100.0	62
16–17	42.8	0.0	0.0	55.8	1.5	100.0	80
18–19	64.7	0.0	0.0	35.3	0.0	100.0	69
20–21	63.5	0.0	0.0	36.5	0.0	100.0	74
22–23	79.0	0.0	0.0	21.0	0.0	100.0	69
24–25	80.5	0.0	0.0	19.5	0.0	100.0	78
26–27	83.9	0.0	0.0	16.1	0.0	100.0	70
28–29	94.3	0.0	0.0	5.7	0.0	100.0	72
30–31	92.2	0.0	0.0	7.8	0.0	100.0	70
32–33	95.4	0.0	0.0	4.6	0.0	100.0	64
34–35	93.2	0.0	0.0	6.8	0.0	100.0	85
< 4 months	3.9	48.3	24.0	23.9	0.0	100.0	120
4–6 months	3.4	17.1	26.4	53.0	0.0	100.0	105
7–9 months	24.6	2.2	2.3	70.9	0.0	100.0	104

Note: Table includes only surviving children from among the two most recent births during the three years preceding the survey. Breastfeeding status refers to the day or night before the interview. Children classified as 'breastfeeding and receiving plain water only' receive no supplements.

percent receive supplements along with breast milk (Table 7.6). The percentage of infants exclusively breastfed drops off rapidly to 17 percent at age 4–6 months and 2 percent at age 7–9 months. No children are exclusively breastfed after nine months of age. The proportion of children receiving supplements along with breast milk increases fairly steadily from 12 percent in the first month of life to 79 percent for children age 10–11 months, and declines thereafter as children are weaned from the breast and their food consumption is no longer supplementing their consumption of breast milk. However, breastfeeding generally continues for a long period. Seventy-six percent of children are still being breastfed at 12–13 months of age, as are 20 percent of children age 24–25 months. By 28–29 months of age, only 6 percent of children are still breastfed.

Table 7.7 shows in more detail the types of food consumed by children under age three years the day or night before the interview. Because of the small number of non-breastfeeding children, two-month age categories have been combined into broader age groups for the younger children. Powdered milk is not routinely given to young children, but other milk (such as cow's milk or buffalo's milk) is given to young children more often. Except for children age 30–35 months, more than two-thirds of non-breastfeeding children in each age group were given these other types of milk the day or night before the interview. Among children age 6–29 months, more than 45 percent of breastfeeding children in each group were given non-powdered milk in addition to breast milk. Other liquids, such as juice or tea, are given much less often than milk. The consumption of green, leafy vegetables generally increases with age, from 2 percent at age

Table 7.7 Type of food received by children

Percentage of children under age 3 years who received specific types of food the day or night before the interview and percentage using a bottle with a nipple by current breastfeeding status and child's age in months, Tamil Nadu, 1999

| Age in months | Type of food received | | | | | | Using bottle with a nipple | Number of living children |
	Powdered milk	Any other milk	Any other liquid	Green, leafy vegetables	Fruits	Any solid or mushy food[1]		
BREASTFEEDING CHILDREN								
< 2	0.0	12.0	0.0	0.0	0.0	0.0	10.0	59
2–3	16.5	28.2	4.5	0.0	0.0	0.0	23.9	56
4–5	9.8	36.0	13.9	1.5	2.0	18.5	30.6	74
6–7	19.0	45.6	25.9	4.3	13.8	56.6	30.9	62
8–9	(8.6)	(72.0)	(27.2)	(23.8)	(6.0)	(88.7)	(25.8)	44
10–11	6.9	59.9	37.2	24.6	26.9	89.5	31.7	81
12–13	7.8	61.6	36.0	20.5	38.0	98.2	35.2	63
14–15	(6.3)	(52.5)	(41.0)	(18.1)	(39.7)	(100.0)	(19.9)	38
16–17	(2.5)	(45.3)	(45.8)	(43.4)	(38.4)	(94.1)	(14.6)	46
18–23	6.3	60.4	59.8	35.3	38.7	99.5	11.1	66
24–29	(0.0)	(56.0)	(63.2)	(40.7)	(49.6)	(100.0)	(4.9)	30
30–35	*	*	*	*	*	*	*	14
< 4 months	8.0	19.9	2.2	0.0	0.0	0.0	16.8	115
4–5 months	9.8	36.0	13.9	1.5	2.0	18.5	30.6	74
6–9 months	14.6	56.6	26.4	12.4	10.5	70.0	28.7	106
NON-BREASTFEEDING CHILDREN								
< 10	(34.6)	(73.8)	(29.1)	(11.4)	(18.5)	(69.0)	(92.0)	34
10–13	(25.6)	(86.6)	(46.4)	(19.0)	(24.7)	(86.6)	(80.0)	38
14–17	10.6	91.0	50.0	39.1	46.6	96.2	51.9	59
18–23	7.1	75.9	47.0	42.1	55.7	95.2	27.7	146
24–29	4.5	68.4	55.6	43.3	51.0	98.1	15.7	189
30–35	2.4	64.5	57.4	45.4	48.8	95.8	13.3	205
< 4 months	*	*	*	*	*	*	*	5
4–5 months	*	*	*	*	*	*	*	1
6–9 months	(37.8)	(72.7)	(26.5)	(13.8)	(22.3)	(74.7)	(90.4)	28
ALL CHILDREN								
< 2	1.8	13.7	0.0	0.0	0.0	0.0	11.7	61
2–3	15.5	30.4	6.3	0.0	0.0	2.0	28.4	60
4–5	9.7	37.0	15.3	1.5	2.0	19.8	31.7	75
6–7	22.4	46.7	23.5	3.9	12.5	53.7	36.7	68
8–9	16.5	73.6	29.4	21.8	13.5	88.8	46.7	66
10–11	14.0	64.6	35.9	24.4	24.8	89.8	42.7	99
12–13	7.6	67.7	42.1	19.2	36.8	94.4	43.1	83
14–15	7.6	69.3	42.3	27.0	44.0	100.0	32.0	62
16–17	6.3	63.4	49.3	41.0	40.7	93.8	30.9	80
18–23	6.9	71.1	51.0	40.0	50.4	96.5	22.6	212
24–29	3.9	66.7	56.7	43.0	50.8	98.3	14.2	219
30–35	2.3	63.9	57.4	46.9	50.3	96.1	14.0	219
< 4 months	8.6	21.9	3.1	0.0	0.0	1.0	20.0	120
4–5 months	9.7	37.0	15.3	1.5	2.0	19.8	31.7	75
6–9 months	19.5	60.0	26.4	12.7	13.0	71.0	41.6	134

Note: Table includes only surviving children from among the two most recent births during the three years preceding the survey.
( ) Based on 25–49 unweighted cases
*Percentages not shown; based on fewer than 25 unweighted cases
[1] Includes green, leafy vegetables and fruits

4–5 months to 47 percent at age 30–35 months for all children. The consumption of fruits increases from 2 percent at age 4–5 months to 50 percent at age 30–35 months.

From about six months of age, the introduction of complementary food is critical for meeting the protein, energy, and micronutrient needs of children. In Tamil Nadu, complementary food is introduced in a timely fashion for most children. Although only 57 percent of breastfeeding children age 6–7 months consume solid or mushy foods, this proportion rises to about 90 percent at age 8–11 months. Seventy percent of breastfeeding children age 6–9 months receive solid or mushy food, as recommended (double the level of 35 percent for India as a whole).

Bottle feeding has a direct effect on the mother's exposure to the risk of pregnancy because the period of amenorrhoea may be shortened when breastfeeding is reduced or replaced by bottle feeding. Because it is often difficult to sterilize the nipple properly, the use of bottles with nipples also exposes children to an increased risk of getting diarrhoea and other diseases. For children who are being breastfed, the use of bottles with nipples is not uncommon in Tamil Nadu. Seventeen percent of breastfeeding children under 4 months old and 31 percent of those age 4–5 months drank something from a bottle with a nipple the day or night before the interview (Table 7.7), considerably higher than the national level of 10 percent for children under 4 months and 16 percent for children age 4–5 months. The use of a bottle with a nipple is much more common for children who are not being breastfed, particularly in the early months of life.

Table 7.8 shows several statistics that describe the duration of breastfeeding. Estimates of both means and medians are based on the current proportions of children breastfeeding in each age group because information on current status is usually more accurate than information based on mother's recall. The median length of any breastfeeding in Tamil Nadu is 16.1 months, 9 months shorter than the national average and much shorter than any other state in India. Supplementation begins relatively early, however. The median length of exclusive breastfeeding is only 1.8 months, and the median length of exclusive breastfeeding or breastfeeding with water is 3.5 months.

The mean durations of any breastfeeding, exclusive breastfeeding, and exclusive breastfeeding or breastfeeding with water only are 17.3 months, 3.1 months, and 4.7 months, respectively. The mean durations are a little more than one month longer than the median durations for all three measures.

An alternative measure of the duration of breastfeeding is the prevalence-incidence mean, which is calculated as the 'prevalence' of breastfeeding divided by its 'incidence'. In this case, prevalence is defined as the number of children whose mothers were breastfeeding at the time of the survey, and incidence is defined as the average number of births per month (averaged over a 36–month period to overcome problems of seasonality of births and possible reference-period errors). For each measure of breastfeeding, the prevalence-incidence mean is less than the mean calculated in the conventional manner by about one month.

The median duration of breastfeeding is two months shorter for girls than for boys. This pattern is often observed in societies where son preference is strong because the parents may stop breastfeeding a girl at a younger age to increase their chances of having another child earlier (with the hope that the next child will be a boy). The median length of breastfeeding is almost four months longer in rural areas than in urban areas (18 versus 14 months). Children in urban areas are exclusively breastfed for a very short median period of less than one month.

Table 7.8 Median duration of breastfeeding

Median duration of breastfeeding among children under age 3 years by sex of child and residence, and mean duration of breastfeeding, Tamil Nadu, 1999

| Background characteristic | Median duration (months)[1] | | | |
	Any breastfeeding	Exclusive breastfeeding	Exclusive breastfeeding or breastfeeding plus water only	Number of children
Sex of child				
Male	17.8	1.4	3.0	700
Female	15.7	1.9	3.8	659
Residence				
Urban	14.2	(0.7)	1.8	467
Rural	18.0	2.1	4.0	892
Median duration	16.1	1.8	3.5	1,359
Mean duration (months)[1]	17.3	3.1	4.7	1,359
Prevalence/incidence mean	16.6	2.0	3.7	1,359

Note: Table includes only the two most recent births in the three years preceding the survey.
( ) Based on 25–49 unweighted cases
[1] Based on current status

7.5 Nutritional Status of Children

Nutritional status is a major determinant of the health and well-being of children. Inadequate or unbalanced diets and chronic illness are associated with poor nutrition among children. To assess their nutritional status, measurements of weight and height/length were obtained for children born in the three years preceding the survey. Children were weighed and measured with the same types of scales and measuring boards used for women. Children under two years of age were measured lying down and older children were measured standing up. Data on weight and height/length were used to calculate the following three summary indices of nutritional status:

- weight-for-age

- height-for-age

- weight-for-height

The nutritional status of children calculated according to these three measures is compared with the nutritional status of an international reference population recommended by the World Health Organization (Dibley et al., 1987a; 1987b). The use of this reference population is based on the empirical finding that well-nourished children in all population groups for which data exist follow very similar growth patterns (Martorell and Habicht, 1986). A scientific report from the Nutrition Foundation of India (Agarwal et al., 1991) has concluded that the WHO standard is generally applicable to Indian children.

The three indices of nutritional status are expressed in standard deviation units (z-scores) from the median for the international reference population. Children who are more than two standard deviations below the reference median on any of the indices are considered to be

undernourished, and children who fall more than three standard deviations below the reference median are considered to be *severely undernourished*.

Each of these indices provides somewhat different information about the nutritional status of children. Weight-for-age is a composite measure that takes into account both chronic and acute undernutrition. Children who are more than two standard deviations below the reference median on this index are considered to be *underweight*. The height-for-age index measures linear growth retardation. Children who are more than two standard deviations below the median of the reference population in terms of height-for-age are considered short for their age or *stunted*. The percentage in this category indicates the prevalence of chronic undernutrition, which often results from a failure to receive adequate nutrition over a long period of time or from chronic or recurrent diarrhoea. Height-for-age, therefore, does not vary appreciably by the season in which data are collected.

The weight-for-height index examines body mass in relation to body length. Children who are more than two standard deviations below the median of the reference population in terms of weight-for-height are considered too thin or *wasted*. The percentage in this category indicates the prevalence of acute undernutrition. Wasting is associated with a failure to receive adequate nutrition in the period immediately before the survey and may be the result of seasonal variations in food supply or recent episodes of illness.

The validity of these indices is determined by many factors, including the coverage of the population of children and the accuracy of the anthropometric measurements. The survey was not able to measure the height and weight of all eligible children, usually because the child was not at home at the time of the health investigator's visit or because the mother refused to allow the child to be weighed and measured. In Tamil Nadu, NFHS-2 did not measure 4 percent of children under age three (see Table B.3 in Appendix B), a much lower nonresponse rate than the national rate of 13 percent. Also excluded from the analysis are children whose month and year of birth were not known and those with grossly improbable height or weight measurements. In addition, two of the three indices (weight-for-age and height-for-age) are sensitive to misreporting of children's ages, including heaping on preferred digits.

Table 7.9 shows the percentage of children classified as undernourished by selected demographic characteristics. Thirty-seven percent of children under three years of age are underweight and 29 percent are stunted. Similar estimates at the national level are 47 and 46 percent, respectively. The proportion of children who are severely undernourished is also high—11 percent according to weight-for-age and 12 percent according to height-for-age. In addition, wasting is quite evident in Tamil Nadu, affecting 20 percent of children under three years of age, higher than the national estimate of 16 percent. The proportion of children under three years of age who are underweight decreased from 46 percent in NFHS-1 to 37 percent in NFHS-2, and the proportion severely underweight decreased from 13 percent to 11 percent.

The proportion of children who are undernourished increases steadily with the child's age through age 12–23 months, where it peaks at 49 percent for underweight, 39 percent for stunting, and 27 percent for wasting. Even during the first six months of life, when most babies are breastfed, 8–18 percent of children are undernourished, according to the three nutritional indices. It is notable that at age 24–35 months, when most children have been weaned from breast milk, 17 percent are severely stunted and 14 percent are severely underweight.

| Table 7.9 Nutritional status of children by demographic characteristics |||||||

Percentage of children under age 3 years classified as undernourished on three anthropometric indices of nutritional status, according to selected demographic characteristics, Tamil Nadu, 1999

Demographic characteristic	Weight-for-age		Height-for-age		Weight-for-height		Number of children
	Percentage below –3 SD	Percentage below –2 SD[1]	Percentage below –3 SD	Percentage below –2 SD[1]	Percentage below –3 SD	Percentage below –2 SD[1]	
Age of child							
< 6 months	0.7	10.4	1.4	7.8	4.2	17.6	175
6–11 months	8.2	26.3	5.4	13.8	3.8	22.5	219
12–23 months	12.6	48.5	15.8	39.3	5.5	26.5	399
24–35 months	14.2	41.9	16.5	37.4	1.8	12.9	403
Sex of child							
Male	11.6	35.8	12.9	29.9	3.4	20.7	625
Female	9.5	37.6	11.1	28.9	4.2	19.0	572
Birth order							
1	9.3	31.0	11.9	27.7	3.5	17.5	519
2–3	11.1	40.2	12.3	29.1	3.9	21.8	568
4–5	12.8	40.5	13.2	38.0	2.5	19.5	92
Previous birth interval[2]							
First birth	9.3	31.0	11.9	27.7	3.5	17.5	519
< 24 months	8.7	41.4	9.8	27.5	2.9	20.1	194
24–47 months	11.2	42.7	13.9	35.4	3.1	21.8	341
48+ months	16.4	36.1	11.2	23.6	7.5	24.2	143
Total	10.6	36.7	12.0	29.4	3.8	19.9	1,196

Note: Each index is expressed in standard deviation units (SD) from the median of the International Reference Population. Total includes 18 children of birth order 6 and above, who are not shown separately.
[1]Includes children who are below –3 SD from the International Reference Population median
[2]First-born twins (triplets, etc.) are counted as first births because they do not have a previous birth interval.

There is not much difference in levels of undernutrition between male and female children. Undernutrition generally increases with increasing birth order, except in the case of wasting where there is no clear pattern. Young children in families with four or more children are nutritionally the most disadvantaged. First births have lower than average levels of undernutrition on all three measures. There is no consistent pattern of nutritional staus by the length of the birth interval.

Table 7.10 shows the nutritional status of children by selected background characteristics. Underweight and stunting are both higher in rural areas than in urban areas, while wasting is slightly higher in urban areas than in rural areas. Children in Chennai are more likely than children in other areas to be underweight (41 percent) and stunted (41 percent), but they are much less likely to be wasted (13 percent). Children whose mothers are illiterate are much more likely to be undernourished than children whose mothers have completed at least high school (see Figure 7.2). As the level of mother's education increases, the percentage underweight, stunted, and wasted declines substantially. Muslim children are slightly more likely than Hindu children and considerably more likely than Christian children to be underweight, stunted, and wasted. Children belonging to scheduled castes have higher levels of undernutrition than children belonging to other backward classes on all three measures. Undernutrition is relatively low for children whose mothers have not worked in the past 12 months, which is not unexpected in the Indian situation where non-working women are likely to be from better off families.

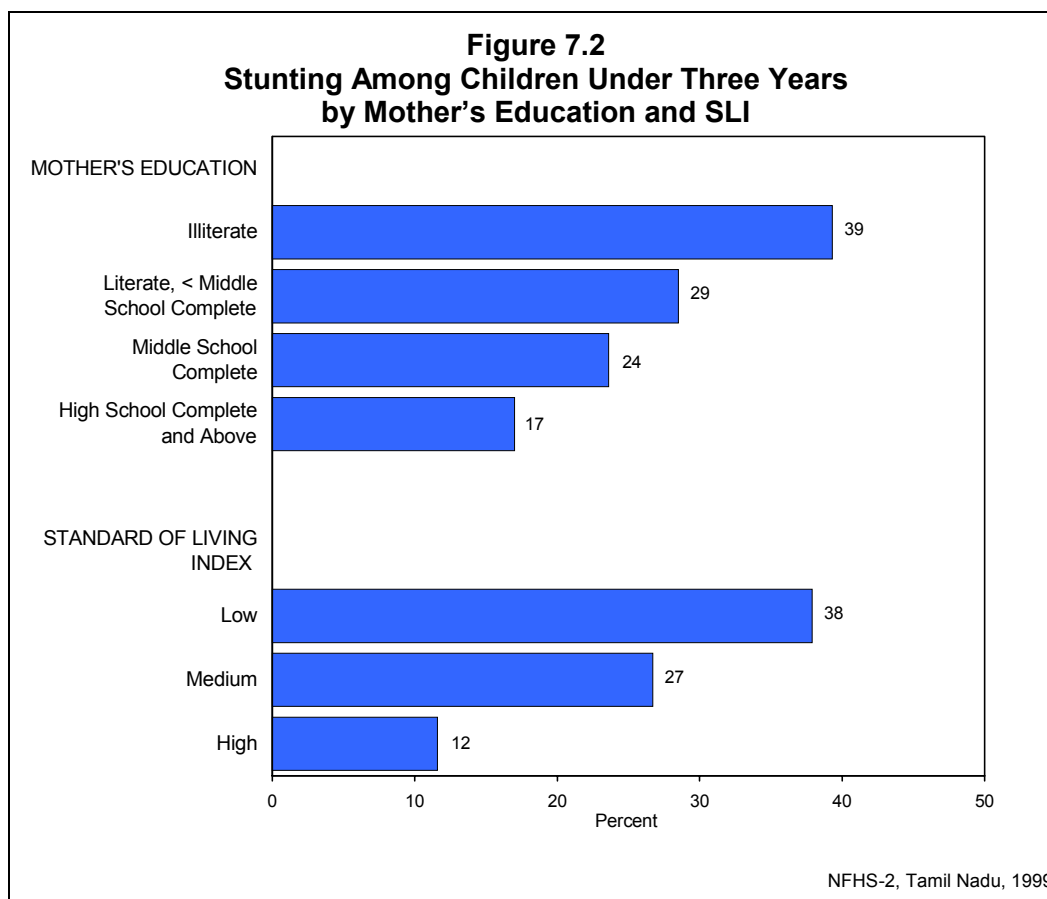Table 7.10 Nutritional status of children by background characteristics

Percentage of children under age 3 years classified as undernourished on three anthropometric indices of nutritional status, according to selected background characteristics, Tamil Nadu, 1999

Background characteristic	Weight-for-age		Height-for-age		Weight-for-height		
	Percent-age below –3 SD	Percent-age below –2 SD[1]	Percent-age below –3 SD	Percent-age below –2 SD[1]	Percent-age below –3 SD	Percent-age below –2 SD[1]	Number of children
Residence							
Urban	9.6	33.5	11.8	27.1	4.5	20.6	414
Rural	11.1	38.3	12.2	30.6	3.4	19.5	782
Chennai	7.5	40.6	21.2	41.0	1.4	12.7	66
Mother's education							
Illiterate	16.0	47.8	17.8	39.3	4.0	22.3	444
Literate, < middle school complete	8.8	37.5	8.1	28.5	4.4	20.7	298
Middle school complete	9.1	31.9	10.2	23.6	4.1	17.9	224
High school complete and above	3.9	18.8	7.8	17.0	2.1	16.3	231
Religion							
Hindu	10.4	36.9	12.1	29.3	3.9	19.8	1,030
Muslim	12.3	38.7	13.1	32.1	1.2	21.4	93
Christian	8.8	28.2	8.2	25.1	4.8	16.6	70
Caste/tribe							
Scheduled caste	14.9	48.1	16.8	41.2	3.2	21.6	301
Other backward class	9.1	32.8	10.1	25.1	4.0	19.3	872
Mother's work status							
Working in family farm/business	6.8	49.0	16.3	34.1	3.0	19.3	88
Employed by someone else	18.2	46.0	17.2	39.2	5.5	22.6	301
Not worked in past 12 months	8.3	32.0	9.9	25.4	3.3	19.1	783
Mother's height							
< 145 cm	22.9	51.9	21.9	42.7	4.9	26.8	120
≥ 145 cm	9.2	35.0	10.9	27.9	3.6	19.1	1,077
Mother's body mass index							
< 18.5 kg/m^2	13.7	48.8	11.8	31.2	5.1	24.7	376
≥ 18.5 kg/m^2	9.2	31.1	12.2	28.6	3.2	17.7	820
Standard of living index							
Low	15.6	47.2	18.0	37.9	4.0	21.8	461
Medium	8.3	35.4	9.3	26.7	4.3	19.9	560
High	3.4	10.3	3.9	11.6	1.6	15.5	159
Total	10.6	36.7	12.0	29.4	3.8	19.9	1,196

Note: Each index is expressed in standard deviation units (SD) from the median of the International Reference Population. Total includes 1 child belonging to an other religion, 9 scheduled-tribe children, 14 children belonging to 'other' caste/tribes, 24 children belonging to mothers who are self-employed, and 2 and 16 children with missing information on religion and the standard of living index, respectively, who are not shown separately.
[1] Includes children who are below –3 SD from the International Reference Population median

The nutritional status of children is strongly related to maternal nutritional status. Undernutrition is more common for children of mothers whose height is less than 145 centimetres or whose body mass index is below 18.5 than for other children. All three measures of undernutrition are strongly related to the household's standard of living. Children from households with a low standard of living are three to four times as likely to be underweight or stunted as children from households with a high standard of living.

**Figure 7.2
Stunting Among Children Under Three Years
by Mother's Education and SLI**

NFHS-2, Tamil Nadu, 1999

7.6   Anaemia Among Children

Anaemia is a serious concern for young children because it can result in impaired cognitive performance, behavioural and motor development, coordination, language development, and scholastic achievement, as well as increased morbidity from infectious diseases (Seshadri, 1997). One of the most vulnerable groups is children age 6–24 months (Stoltzfus and Dreyfuss, 1998).

In Tamil Nadu, haemoglobin levels were tested for 95 percent of children (see Table B.3 in Appendix B). Table 7.11 and Figure 7.3 show anaemia levels for children age 6–35 months. Overall, more than two-thirds (69 percent) of these children have some level of anaemia,[5] including 22 percent who are mildly anaemic (10.0–10.9 g/dl), 40 percent who are moderately anaemic (7.0–9.9 g/dl), and 7 percent who are severely anaemic (less than 7.0 g/dl). These rates are lower than those at the national level, except for severe anaemia, which is slightly higher in Tamil Nadu. Notably, a much larger proportion of children (69 percent) than women (57 percent) are anaemic, and the difference is particularly pronounced for moderate anaemia.

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[5]Rates that are not adjusted for altitude (67.9 percent for any anaemia, 22.0 percent for mild anaemia, 40.3 percent for moderate anaemia, and 5.6 percent for severe anaemia) are slightly lower than the corresponding adjusted rates for any anaemia and severe anaemia, and about equal for mild and moderate anaemia.

Table 7.11 Anaemia among children

Percentage of children age 6–35 months classified as having iron-deficiency anaemia by selected background characteristics, Tamil Nadu, 1999

| Background characteristic | Percentage of children with any anaemia | Percentage of children with: | | | Number of children |
		Mild anaemia	Moderate anaemia	Severe anaemia	
Age of child					
6–11 months	60.8	19.6	39.4	1.7	221
12–23 months	74.1	21.7	41.4	11.0	412
24–35 months	68.4	23.3	39.5	5.6	420
Sex of child					
Male	72.4	22.5	42.3	7.6	553
Female	65.3	21.1	38.0	6.1	500
Birth order					
1	66.3	22.7	37.4	6.1	450
2–3	70.0	22.0	39.2	8.8	504
4–5	74.6	15.5	57.5	1.5	81
Residence					
Urban	66.2	23.1	36.4	6.7	366
Rural	70.5	21.2	42.3	7.0	687
Chennai	62.6	23.1	34.0	5.4	63
Mother's education					
Illiterate	76.0	19.7	47.7	8.7	400
Literate, < middle school complete	64.8	21.7	36.7	6.4	265
Middle school complete	70.3	25.4	38.3	6.6	193
High school complete and above	59.3	23.2	31.8	4.3	196
Religion					
Hindu	69.2	21.5	40.7	7.0	913
Muslim	71.7	21.4	40.0	10.3	77
Christian	61.7	26.0	33.8	1.8	60
Caste/tribe					
Scheduled caste	73.3	22.3	43.2	7.8	271
Other backward class	67.7	21.7	39.2	6.8	762
Mother's work status					
Working in family farm/business	72.7	22.6	44.0	6.1	83
Employed by someone else	73.4	21.4	42.8	9.2	284
Not worked in past 12 months	67.0	22.3	39.2	5.6	664
Standard of living index					
Low	73.9	20.2	45.0	8.7	417
Medium	67.1	22.5	38.2	6.5	480
High	59.2	24.9	30.8	3.5	140
Mother's anaemia status					
Not anaemic	60.6	23.5	34.2	2.9	415
Mildly anaemic	69.4	20.5	44.4	4.4	409
Moderately anaemic	81.9	22.7	47.1	12.2	186
Severely anaemic	(91.8)	(16.6)	(29.1)	(46.1)	43
Total	69.0	21.9	40.2	6.9	1,053

Note: Haemoglobin levels are adjusted for altitude when calculating the degree of anaemia. Total includes 18 children of birth order 6 and above, 1 child belonging to an other religion, 9 scheduled-tribe children, 11 children belonging to 'other' caste/tribes, 23 children belonging to mothers who are self-employed, and 2 and 17 children with missing information on religion and the standard of living index, respectively, who are not shown separately.
( ) Based on 25–49 unweighted cases

Figure 7.3
Anaemia Among Children

NFHS-2, Tamil Nadu, 1999
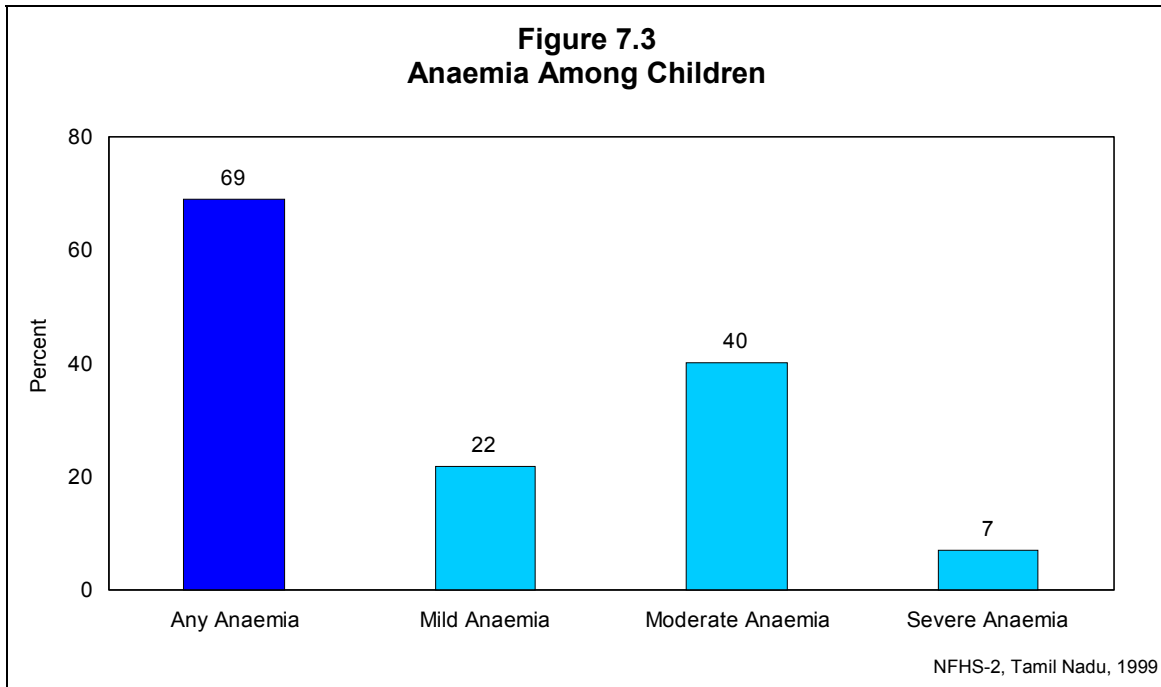
Several groups of children have particularly high levels of anaemia. These include children age 12–23 months (an age at which children are often being weaned), boys, children of higher birth orders, children in rural areas, Muslim children, children from scheduled castes, children of working women, and children from households with low standard of living. The prevalence of anaemia is lower among children whose mothers have received at least a high school education than among children whose mothers are illiterate or have less than a high school education. As expected, there is a strong positive relationship between the anaemia status of mothers and prevalence of anaemia among children. Despite these differentials, anaemia is very widespread in Tamil Nadu. More than 59 percent of children in every group shown in the table are anaemic.

7.7   Iodization of Salt

Iodine is an important micronutrient. A lack of iodine in the diet can lead to Iodine Deficiency Disorders (IDD), which, according to the World Health Organization, can cause miscarriages, brain disorders, cretinism, and retarded psychomotor development. Iodine deficiency is the single most important and preventable cause of mental retardation worldwide.

It has been estimated that 200 million people in India are exposed to the risk of iodine deficiency and 70 million suffer from goitre and other IDDs (IDD & Nutrition Cell, 1998). In addition, about one-fifth of pregnant women are at considerable risk of giving birth to children who will not reach their optimum physical and mental potential because of maternal iodine deficiency (Vir, 1995).

Iodine deficiency can be avoided by using salt that has been fortified with iodine. In 1983–84, the Government of India adopted a policy to achieve universal iodization of edible salt by 1992. In 1988, the Prevention of Food Adulteration Act was amended to fix the minimum iodine content of salt at 30 parts per million (ppm) at the manufacturing level and 15 ppm at the consumer level (Ministry of Health and Family Welfare, 1994). The Government of India

advised all states and union territories to issue notifications banning the sale of edible salt that is not iodized. However, the ban on non-iodized salt was lifted in September 2000.

NFHS-2, with its representative sample of households throughout Tamil Nadu, is an ideal vehicle for measuring the degree of salt iodization in the state. Iodine levels in salt can be measured in the laboratory using a standard titration test or in the field using a rapid-test kit. In NFHS-2, interviewers measured the iodine content of cooking salt in each interviewed household using a rapid-test kit. The test kit consists of ampoules of a stabilized starch solution and of a weak acid-based solution. The interviewer squeezes one drop of the starch solution on a sample of cooking salt obtained from the household respondent. If the colour changes (from light blue through dark violet), the interviewer matches the colour of the salt as closely as possible to a colour chart on the test kit and records the iodine level as 7, 15, or 30 ppm. If the initial test is negative (no change in colour), the interviewer is required to conduct a second confirmatory test on a new salt sample, using the acid-based solution in addition to the starch solution. This test is necessary because the starch solution will not show any colour change even on iodized salt if the salt is alkaline or is mixed with alkaline free-flow agents. If the colour of the salt does not change even after the confirmatory test, the salt is not iodized. Because of uncertainties and subjective judgement in the matching process, the rapid test should not be seen as giving an exact quantitative estimate of salt iodization, but it does provide useful information on whether or not salt is iodized, as well as the extent of iodization. A recent multicentric study in eight centres in India concluded that the rapid test kit can be used for semi-quantitative estimation of the iodine content of salt to monitor the quality of salt being used in a community (Kapil et al., 1999).

Table 7.12 shows the extent of salt iodization at the household level. Overall, only 21 percent of households in Tamil Nadu use cooking salt that is iodized at the recommended level of 15 ppm or more, compared to 49 percent of households in India as a whole. This level is quite low in light of the government regulations on salt iodization that were in effect at the time of the survey. Almost two-thirds of households (63 percent) use salt that is not iodized at all and 16 percent use salt that is inadequately iodized (less than 15 ppm). Differentials in salt iodization by background characteristics are pronounced. Thirty-six percent of households in large cities in Tamil Nadu use salt with 15 ppm or more of iodine, compared with 38–40 percent of households in small cities and towns and only 12 percent of households in rural areas. Households with Christian (33 percent) heads are much more likely to use iodized salt than households with either Muslim (26 percent) or Hindu (20 percent) heads. The use of iodized salt is lower in households headed by persons from scheduled castes or scheduled tribes than in households headed by persons from other backward classes and especially those from 'other' castes. Wide differentials are also observed for the standard of living index. Fifty-four percent of households with a high standard of living use salt with 15 ppm or more of iodine, compared with only 11 percent of households with a low standard of living.

Table 7.12 Iodization of salt

Percent distribution of households by degree of iodization of salt, according to selected background characteristics, Tamil Nadu, 1999

Background characteristic	Not iodized	7 ppm	15 ppm	30 ppm	Missing	Total percent	Number of households
Type of place of residence							
Large city	55.5	8.0	15.0	20.5	1.0	100.0	347
Small city	39.3	21.7	12.8	25.6	0.6	100.0	594
Town	45.1	15.0	10.6	28.9	0.4	100.0	856
Rural	71.7	15.8	6.0	6.4	0.1	100.0	3,484
Religion of household head							
Hindu	63.8	15.8	8.0	12.1	0.3	100.0	4,705
Muslim	56.9	16.3	7.8	18.4	0.5	100.0	281
Christian	51.7	15.8	8.8	23.7	0.0	100.0	279
Caste/tribe of household head							
Scheduled caste	69.8	16.6	5.7	7.6	0.3	100.0	1,241
Scheduled tribe	(83.5)	(0.0)	(10.7)	(5.8)	(0.0)	100.0	47
Other backward class	61.1	15.9	8.6	14.1	0.3	100.0	3,875
Other	31.0	11.9	14.1	42.7	0.3	100.0	115
Standard of living index							
Low	74.0	15.1	5.7	4.9	0.3	100.0	2,191
Medium	60.6	18.1	8.4	12.9	0.1	100.0	2,324
High	35.0	10.9	14.6	39.1	0.4	100.0	712
Total	62.7	15.8	8.1	13.1	0.3	100.0	5,281

Note: Total includes 8 households with a household head belonging to other religions and 8, 2, and 55 households with missing information on religion, caste/tribe, and the standard of living index, respectively, which are not shown separately.
ppm: Parts per million
( ) Based on 25–49 unweighted cases