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YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY 1979

YEMEN ARAB REPUBLIC
NATIONAL NUTRITION SURVEY
1979

conducted by

The Yemen General Grain Corporation
Ministry of Supply

in cooperation with the

Ministry of Health
Yemen Arab Republic

with the assistance of the

U.S. Department of Health and Human Services
Public Health Service
Centers for Disease Control

and the

United States Agency for International Development
Department of State
Washington, D.C.

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PREFACE

In response to a request from the Yemen General Grain Corporation (YGGC) of the Ministry of Supply and the Central Planning Organization (CPO) of the Yemen Arab Republic to the United States Agency for International Development (USAID) Mission in Sana'a, the Nutrition Division, Center for Disease Control (CDC) of the United States Department of Health and Human Services provided technical assistance to the YGGC in conducting a National Nutrition Survey in the Yemen Arab Republic during 1979.

The 1979 Yemen Arab Republic National Nutrition Survey was made possible by the combined efforts of the Government of the Yemen Arab Republic, of the United States Agency for International Development (USAID) in Sana'a and Washington, of the International Bank for Reconstruction and Development (IBRD - the World Bank), and of CDC.

The Yemen Arab Republic provided the survey personnel, survey vehicles, logistic and administrative support, and training sites. The conscientious efforts of the YGGC staff and of the survey team members under often uncertain and difficult circumstances greatly facilitated the successful completion of the survey. A complete list of survey personnel appears in Appendix I.

The AID Development Support Bureau/Nutrition in Washington provided funds for the CDC technical advisors, for technical advisors from the Nutrition Institute, Ministry of Health of the Arab Republic of Egypt (ARE), and for essential equipment and supplies, data analysis and preparation of the survey report.

The YGCC and IBRD provided funds for the Yemeni survey personnel and for other in-country survey costs, as well as for logistic support to the CDC and Nutrition Institute ARE technical advisors. The Ministry of Health of the Yemen Arab Republic provided valuable technical consultation and advice. Particular acknowledgement for assistance from persons from these and other organizations appears in Appendix II.

INTRODUCTION

The Yemen Arab Republic (hereafter referred to as Yemen) occupies an area of some 200,000 km^2 in the southeastern corner of the Arabian Peninsula. It is a rugged mountainous country, bordered on the north and northeast by Saudi Arabia, on the south and southeast by the Peoples' Democratic Republic of Yemen, and on the west by the Red Sea. Its estimated national population in 1979, based upon extrapolation from the Population and Housing Census of February 1975, is approximately 6.5 million persons. Some three quarters of the population are rural, directly engaged in agriculture, with the urban population centered mainly in the three largest cities: Sana'a, the national capital, Ta'izz in the Southern Highlands, and Al Hudaydah on the Red Sea. Approximately 18 percent of the population is under the age of 5 years.

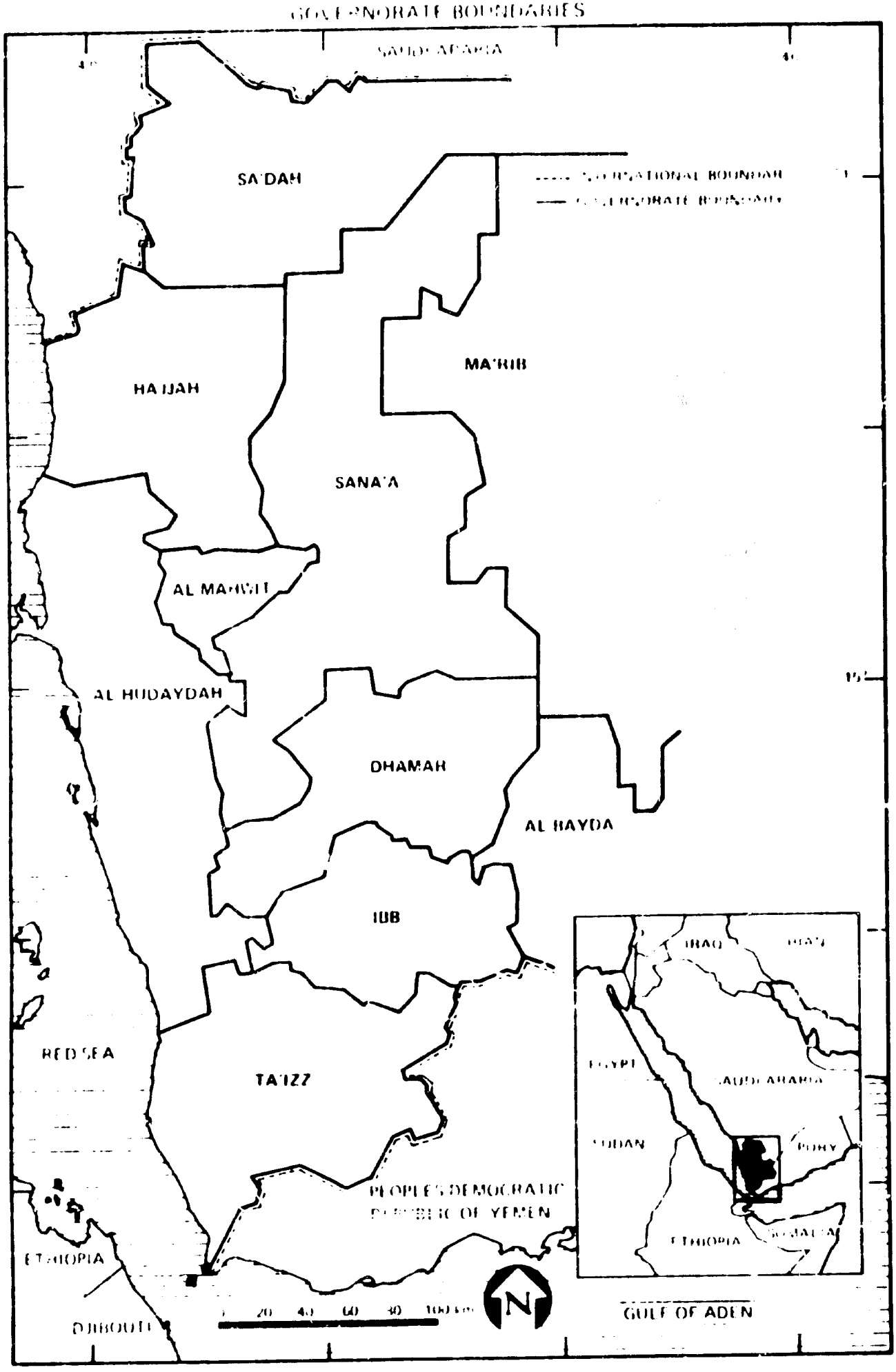
The overall population density is some 30 persons per km^2, with the greatest concentrations in the Southern Highlands and smallest in the Yemeni quarter of the great Arabian desert in the east. The nation is divided administratively into 10 Mouhafazah (governorates or provinces) in which primary authority for most governmental functions is vested. These are subdivided into some 40 Qada (subprovinces) and further divided into some 170 Nahiya (districts). In Figure 1 the 10 Mouhafaza boundaries are shown.

Among the most serious public health problems of Yemen, malnutrition among children of preschool age has been cited by several authorities (1,2). Several small-scale nutrition surveys of Yemeni children have provided estimates ranging from 25 percent to 75 percent prevalence of undernutrition (protein-energy malnutrition) in the under-five year population, using the index of weight for age. Differences in survey sampling and methodology, in the time of year and the geographic region in which the survey was conducted, and in the use of various reference populations and cut-off values make direct comparison of data from these different surveys difficult, but the evidence suggests that large numbers of young Yemeni children are undernourished.

Anemia has also been noted to be common among Yemeni children and their mothers, with reported prevalences around 50 percent in some study populations (3).

Figure 1

YEMEN ARAB REPUBLIC
GOVERNORATE BOUNDARIES



GOALS AND OBJECTIVES

The overall goal of the 1979 National Nutrition Survey of the Yemen Arab Republic was to provide baseline data on the nutritional status of preschool age children which would be useful for determining priorities for planning and managing applied nutrition programs, and suggesting further nutrition research needs.

Toward this goal the survey has developed data, presented in this report, on:

* Prevalences and distributions, among various demographic and geographic subgroups, of stunted linear growth (chronic undernutrition) and wasted body mass (acute undernutrition) in children from age 3 months to 5 years.
* Prevalences and distributions of low hemoglobin (anemia) in these children and their mothers, and of clinical signs suggestive of certain micronutrient deficiencies in the children.
* Duration of breast-feeding and patterns of infant feeding and weaning.
* Associations of children's nutritional status with certain socioeconomic and demographic characteristics of their families and of individual family members.
* Estimates of foods consumed by children and their families, to determine dietary intake patterns.

SURVEY METHODOLOGY

I. SELECTION OF SURVEY REGIONS (UNIVERSES) AND SAMPLING METHODS

A. Survey Universes

The survey concerned itself with only seven of Yemen's ten Mouhafazah. These were Hajjah, Al Hudaydah, Ta'izz, Ibb, Dhamar, Al Mahwit, and Sana'a, the combined population of which comprise over 90 percent of Yemen's total population. Yemen's total population was excluded due to logistic difficulties. The Sa'dah Mouhafazah, with about 3 percent of the two additional Mouhafazah, Marib and Al Bayda, comprising about 49 percent of Yemen's total area but less than 5 percent of its population, are situated in the vast eastern desert and are sparsely populated, mainly with nomadic peoples who are remote from vehicular roads. These factors, together with distinct limitations of survey time and resources, made it necessary to exclude these three Mouhafazah from the sampling frame.

Marked differences in elevation divide rural Yemen into two distinct ecologic regions with differing geo-climatic, agricultural and socio-cultural characteristics. The western region, below approximately 500 meters altitude and extending westward to the Red Sea, is known as the Tihama, a narrow arid lowland rarely exceeding 50 km in width, but extending some 400 km in a north-south direction. For survey purposes, the Tihama, designated as rural Universe 1, consisted of the

three lowland Nahiya of Hajjah (Harad, Midi and Abs), of all of Al Hudaydah except for its three highland Nahiya (Bura, Al Hujjaylah and Jabal Ras), and of the three lowland Nahiya of Ta'izz (Al Mukha, Mawza and Al Wazi'iyah). To the east of the Tihama, the upland, mountain and plateau regions which extend in an easterly direction to the borders of Marib and Al Bayda were designated as rural Universes 2 and 3: the Southern and Northern Highlands. The Southern Highlands, made up of the remainder of Ta'izz and all of Ibb, are ecologically and culturally distinct from the Northern Highlands, which consist of the remainder of Hajjah, of the three highland Nahiya of Al Hudaydah and of all of Dhamar, Al Mahwit, and Sana'a. The Southern Highlands enjoy greater rainfall and agricultural productivity, and are considerably more densely populated than the Northern Highlands.

In addition to these three rural Universes, a fourth Universe, urban in character, was designated for the city of Sana'a, the national capital, with a population of about 200,000.

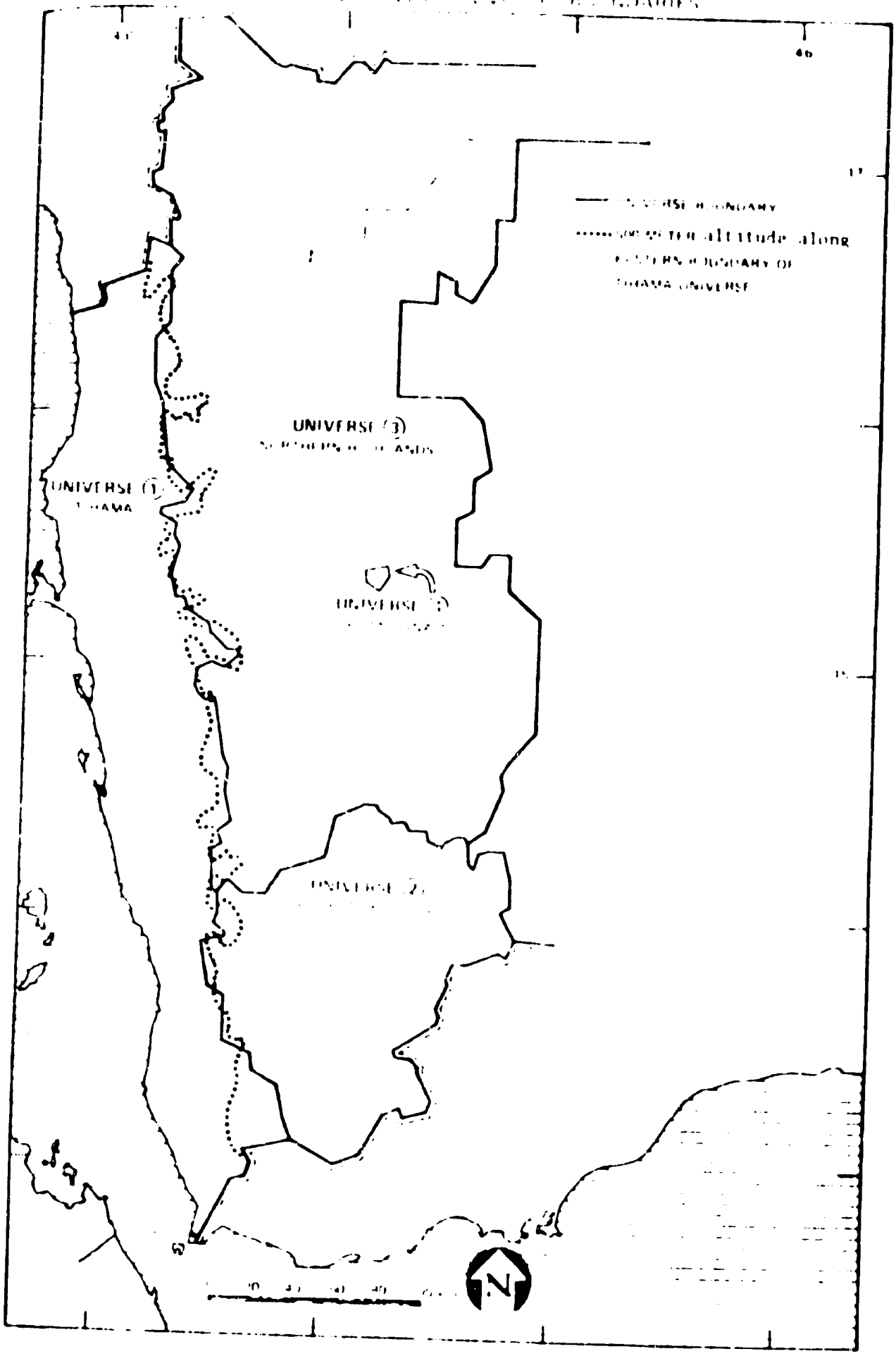
The other two major cities of Yemen, Al Hudaydah and Ta'izz, each with an estimated 1975 population of 80,000 persons, were not included in rural regions 1 or 2. Neither were they included in urban region 4 because of demographic differences from Sana'a City, nor as separate urban regions because of

survey constraints. Also excluded from rural regions 1, 2, and 3 were the following twelve cities or large towns, arbitrarily categorized as predominately urban in character: Bajil, Bayt Al Faqih, Marawa'a and Zabid in Al Hudaydah, Ibb, Jeblah and Yarim in Ibb, Rawdah in Sana'a, and the capital centers of Hajjah, Sa'dah, Al Mahwit and Dhamar. The estimated 1975 population of these twelve cities combined was some 100,000 persons.

The composition of these four regions, or Universes, is shown in Figure 2.

Figure 2

YEMEN ARAB REPUBLIC



B. Sampling Methods

The survey sampling methods used took into account:

- available resources, both physical and financial,
- time and field logistics,
- estimates of the expected prevalence of major survey attributes, and
- precision and confidence levels desired to describe each attribute adequately.

In each region, sample sites were selected by a two-stage sampling procedure. For the first stage, 30 sample sites in each region were selected from the total population of that region, as listed in the 1975 census. The procedure involved population unit cumulation and interval sampling, so that the probability of including any population unit was proportional to the size of that unit's population. For the Yemen survey this unit was the Ozlah (subdistrict), which is comprised of a group of Qaryah (villages), usually under the jurisdiction of one sheikh (tribal leader). The locations of the 120 sites and their names are shown in Appendix III. The rationale for sample size determinations is included in Appendix IV.

Second-stage sampling, the choice of that subpopulation within a sample site to be actually surveyed, involved compiling a list of inhabited houses and randomly selecting

from that list an initial household in which to begin the survey. After surveying the initial household, a cluster of surrounding households was then visited, moving whenever possible to the next nearest house on the right.

The number of households to be visited at each site was determined to be that number which contained a sufficient number of household inhabitants to provide a mean number of 30 children of appropriate age per sample site.

The variable number of households, persons and children enumerated in the various survey sites, as a result of this second-stage sampling procedure, necessitated a series of statistical weighting procedures in the data analysis.

This two-stage sampling method permits prevalence estimates of approximately the same precision within each region, and permits the use of statistical testing to determine whether significant differences in certain nutritional status indicators exist between regions.

II. DATA COLLECTION AND SURVEY LOGISTICS

Beginning in early June 1979, a staff of 25 persons - nine women and 16 men - received an intensive training course prior to initiating the data collection phase of the survey. All had secondary school certificates and most were university students

free to work on the survey during their summer holiday. The staff consisted of 21 survey enumerators, three survey supervisors and one laboratory technician. The staff was divided into six 3-person teams - each with two men and one woman, and each with its own cross-country type vehicle and driver, one reserve team, three supervisors, and the laboratory technician. The training course for the men, lasting 4 weeks and conducted in Arabic with the assistance of two Egyptian physician-nutritionists, included instruction in sampling, interviewing, measuring height-weight and certain clinical signs, and collecting blood specimens. The women's training concentrated on interview procedures to elicit information on infant feeding practices and dietary intake. Team performance, during classroom training, was evaluated using a standardization exercise adapted from that proposed by Habicht (4). The teams obtained further proficiency in interview and examination techniques during field trials in several villages which were not included in the survey sample.

A sample questionnaire (Form 1) is presented both in Arabic and English in Appendix V. Details for administering these questionnaires in a uniform, reproducible manner are available in the two Field Training Manuals for the Yemen Arab Republic Nutrition Survey.

Data collection took place from early July until late October 1979, with suspension during the Islamic month of Ramadan which occurred in 1979 from late July to late August.

All teams worked in the same region at the same time until all of the sample sites in that region had been visited. For logistic and political reasons, three sites in the Northern Highlands - two in the Sa'dah Mouhafazah and one in the Sana'a Mouhafazah - could not be completed.

The Northern Highlands universe was redefined to exclude the Sa'dah Mouhafazah. Appropriate weighting has been made in statistical analysis of the Northern Highlands data to adjust for the absence of information from the Sana'a Mouhafazah . The teams worked for a period of 15 days in the Southern Highlands, completing this region just before Ramadan. After Ramadan they worked for 30 days in the Tihama and in those Highland sites accessible only from the Tihama. They then completed the Northern Highlands, returning to Sana'a periodically for rest, and finally they surveyed the sites in urban Sana'a. Supplies were distributed, and completed forms and blood specimens collected at several central provincial and district locations. While working in the Tihama and Southern Highlands, all hemoglobin determinations were performed in these centers.

During all field work, supervisory staff from CDC, from the ARE Nutrition Institute and from the YGGC traveled with the teams to each sample site to optimize quality control of the collected data. Survey team leaders edited each questionnaire for accuracy, clarity and completeness, and supervisory personnel then reviewed all completed questionnaires in the field, with periodic review days for group discussion of work quality in order to minimize error.

Completed forms were photocopied, the copies remaining in Sana'a and the originals being sent to Atlanta for computer processing and data analysis at the CDC. Analyses and tabulations utilized a series of core computer programs for common nutritional status indicators as well as specially written programs for associations specific to the Yemen survey.

III. DATA COLLECTED

Careful estimates of age and direct measurements of height, weight and hemoglobin provide data on prevalence and distribution of key indices of nutritional status among children (5). Hemoglobin determinations on mothers of these children provide similar information regarding maternal anemia.

Indirect measures, employing structured interview techniques, provide data on certain demographic, socioeconomic, clinical and dietary factors closely associated with nutritional status.

A. Direct measurements

1. Anthropometry (body measurements)

Height and weight were measured on all children 3 through 59 months of age inclusive, using a standard portable measuring board and a Salter spring scale.

2. Hemoglobin

Hemoglobin values were determined on capillary blood from every fifth survey child, and from his or her mother, by the cyanmethemoglobin method using a Fisher #74D hemophotometer.

3. Clinical Signs

The presence or absence of signs suggestive of certain nutritional disorders were determined for each survey child. These signs included bilateral pretibial edema, angular stomatitis, and five signs consistent with vitamin D deficiency. Other signs, such as those related to vitamin A deficiency, were considered for inclusion in the survey but were eliminated because of lack of evidence that these items were of public health significance.

B. Indirect Data from All Households

- Household size
- Household informant
- Is a household member working in a nearby country?

  If yes: In what country?

  What is his occupation there?

  For what is his remittance spent?

- Is a household member a child 3 through 59 months of age inclusive?

  If no: go on to the next household

  If yes: complete the remainder of the questionnaire

C. Indirect Data from Only Those Households with a Survey Child

1. Age Determination

Age data for the survey children were obtained as date of birth from a birth registration form if it existed, and if the recorded date of birth could be verified using a local historical calendar. In the absence of a registration form, date of birth was obtained, to the year and month, with the aid of the historical calendar and a simplified computation matrix. If date of birth was recorded in a family Koran, it was so noted.

2. Information from the Mother Only

- Years since first married?
- If survey child is first-born, how many months since first married until its date of birth?
- If survey child is second or later born, how many months since previous child's birth date until survey child's date of birth?
- How many children were born alive?
- How many children are living today?
- Has she given birth to a child in the past 3 months?
- Is she presently pregnant?
- Is she presently nursing any child?

3. Information from the Mother, or from Another Informant

- Birth order of the survey child
- Is the survey child presently breast-feeding:

  If no: at what age did it last breast-feed?
- At what age did the survey child first receive:

  milk in a bottle:

  other food?
- Clinical symptoms. In the past 6 days has the survey child:

  been sick, that is, unable to eat, play, etc.?

  had a fever for more than 2 days?

  had diarrhea, that is, four or more watery stools per day for more than 2 days?

- Questions of the father

  Can the father read or write?

  If yes: what is his highest school certificate?

  What is his full-time occupation?

- Socioeconomic indicators

  How long does it take to reach your source of water

  Does the house have electricity?

  What type of fuel is used in cooking?

4. Dietary Data

Dietary data were collected on every second child, age 3 through 30 months of age. Complete reliable data were available for 903 children.

The qualitative dietary questionnaire included 55 foods which were arranged in 17 major categories. The informant for the dietary component was the mother or primary care provider. It was anticipated this individual could readily identify those foods consumed by the child and foods available to the family. The mother was asked what did the child eat the previous day. After the mother responded, the interviewer repeated the items to confirm her response, and then asked about items not mentioned.

After completing the portion about the child's intake, the same questions were asked concerning those items eaten by other family members during the same day. This question was interpreted as those items available to family members at home during a meal. Items consumed outside of the home and the various dietary patterns of family members were not determined.

5. Family Planning Data

The mother of every child from whom a blood sample was obtained was asked three questions concerning the use of child-spacing measures:

Are any such measures being used?

If yes: What method is used?

Where is it obtained?

IV. ANALYTIC METHODOLOGY

A. Anthropometry (body measurement)

Measurements of linear growth and body mass are key indices for characterizing the nutritional status of children. The risk of undernutrition for a population of children increases as the prevalence of low values of certain anthropometric indices increase. Values of three of these simple anthropometric indices in a study population, compared with reference population data and classified using appropriate cut-off levels, permit quantification of the magnitude and distribution of acute and chronic undernutrition in that population.

The index of weight for height relates observed body mass to expected body mass for observed body length. A severe deficit of weight for height, or wasting, is consistent with short-term, acute undernutrition. High prevalences of severe wasting occur in times of famine.

The index of height for age relates observed body length to expected body length for observed age. Linear growth retardation, or stunting, does not become manifest during short-term undernutrition, but after a sustained period of marked nutritional deficiency, or with recurrent episodes of severe acute undernutrition, stunting will result. Although subsequent improved nutrition may diminish stunted linear growth over a period of time, complete "catch-up" growth usually does not occur if an episode of growth retardation has been prolonged and severe.

The index of weight for age, which relates observed body mass to expected body mass for observed age, has in the past been the anthropometric index most commonly used. It is particularly useful if successive weight measurements of an individual child are taken over a period of time. A single weight for age determination is less useful, as a low value of itself cannot distinguish between a tall child who is underweight because of being wasted, a short but well-proportioned child who is underweight because of being

stunted, or one who may have some combination of both wasting and stunting; each condition having different health implications.

In this report, tabular and graphic presentations of the prevalence and distribution of stunting, wasting, and low weight for age are based upon computations comparing observed values with those in a reference population. Cutoff values are based upon standard deviations (SD) of the reference population. Values more than two standard deviations below the reference mean (-2 SD) have been defined as undernutrition (6) for each of the three anthropometric indices.

An alternate method used in many studies in the past has been a comparison of observed prevalences below selected arithmetic percentages of the reference median value ("percent of median"). This method has less sensitivity and specificity than using standard deviations, since at different levels of age or body length percent of median levels conform less closely to reference centiles. The percent of median method assumes implicitly that the coefficient of variation (standard deviation divided by the mean) remains fixed over the entire range of values, whereas the actual distributions of these anthropometric reference values, as of most sets of biological values, are such that

the coefficient of variation is greater toward the lower end of a set of values and smaller toward the upper end. The commonly used percent of median levels (90 percent height for age, 80 percent weight for height, and 75 percent weight for age) correspond to between 2.0 and 3.0 standard deviations below the mean. In the ranges of age and body size of these Yemeni children, 90 percent height for age tends to vary between 2.2 and 2.7 standard deviations below the mean while both 80 percent weight for height and 75 percent weight for age tend to vary between 1.6 and 2.6 standard deviations below the mean.

For comparative purposes, prevalences of low values of the three anthropometric indices will be presented in Appendix VI using percent of median cut-off values recommended by Jelliffe (7) and by Gomez et al (8).

B. Reference Population

Based upon recommendations of the World Health Organization, the National Center for Health Statistics/Center for Disease Control (NCHS/CDC) normalized reference data are used for the anthropometric analyses of these data (9,10). Although the median values of these reference data are quite similar to those of the Stuart-Meredith data, commonly used in the past, the distributions of values about the median are considerably wider. The larger numbers of children measured in the more

recent past, the improved sampling methods, true rather than derived weight for height values, and the complete statistical description available for the NCHS/CDC reference data permit improved statistical accuracy in anthropometric analysis.

C. Anthropometric Classifications

To be useful as indices of undernutrition, both height for age and weight for age require accurate estimation of a child's age, information often difficult to obtain in developing countries. Weight for height, which is relatively independent of age, may thus be of greater usefulness in situations where children's exact ages are not known or well remembered, particularly if acute undernutrition due to recent nutritional deprivation is a major problem (as in famine situations). Height for age and weight for age summary statistics are biased by inaccurate age determinations.

Waterlow and Rutishauser (11) have proposed a system of classification which permits the combined assessment of stunting and wasting in children by cross-classifying the two indices, and thus permitting categorization of children who are (1) neither stunted nor wasted, (2) stunted but not wasted, (3) wasted but not stunted, and (4) both stunted and wasted. These are four distinct categories with each

condition having different health implications. For this cross-classification scheme, 2.0 standard deviations below the mean will again be used as the cut-off level for each index.

D. Hemoglobin

The prevalence of low hemoglobin values and the distribution of the range of hemoglobin values in different regions of Yemen and in different age and other subgroups describe the general problem of anemia among Yemeni preschool age children, and among Yemeni women who have at least one child in the survey age range.

In general, WHO criteria for anemia are used, with all survey children and pregnant women whose hemoglobin levels are less than 11.0 grams per deciliter (g/dl) being defined as anemic. For non-pregnant women, 12.0 g/dl is used as the cut-off level.

RESULTS AND DISCUSSION

Differences between subgroups, when statistically significant, are usually so noted but it should be borne in mind that differences which are statistically significant may not be of biologic or programmatic importance. Similarly, differences which are not statistically significant could in fact be of biological or programmatic importance, and might have attained statistical significance had the sample size or the precision of the measure been greater. Some examples of survey precision are given in Appendix IV.

Data from the four geopolitical regions of Yemen are analyzed individually and in several aggregates. These regions and aggregates are as follows:

- the Tihama	- Region 1 (rural)
- the Southern Highlands	- Region 2 (rural)
- the Northern Highlands	- Region 3 (rural)
- rural Yemen	- Regions 1, 2, and 3 combined
- Sana'a City	- Region 4 (urban)

I. Demographic Characteristics

Because of regional demographic variations within Yemen which could not be quantified in advance by available census data, it was not possible to anticipate exactly, or even within reasonable approximation, how many persons or households each survey team should enumerate in each sample site in order that a mean number of 30 children per site would be surveyed in each region. Based

upon available data, 36 households, containing an average of 200 persons of all ages, appeared to be reasonable presurvey estimates for the average numbers required per sample site. Field realities demonstrated that selection of 36 households would not yield a uniform number of total people in each cluster and the variation in the number of children of survey age would be too variable to predict daily work loads.

A. Sampling Variations

Soon after starting the survey in the Southern Highlands it became clear that this region had an unusually high number of children per household, and that 180 persons per site would probably be sufficient to yield a mean of 30 children per site. But in the next region, the Tihama, it became evident after completing the first six sites that relatively fewer households yielded survey age children, and relatively fewer children were present in households. In the remaining 24 Tihama sites, the survey teams were instructed to enumerate 220 persons per site. In the Northern Highlands, fewer households per site were required than in the Tihama but just as many persons were required per site. These observed demographic differences, and others, among the four survey regions are presented in Table 1.

B. Demographic Variations

In Table 1 the mean number of households, persons, and children per survey site are shown as well as several additional rates derived from these figures.

The Tihama had the smallest mean number of persons per household of any region (5.3), and urban Sana'a had the greatest (7.0) ($p < .001$).

C. Statistical Weighting

Each sample site was assigned a weight such that the total number of children with data were redistributed to account for missed children and slight variations in total people visited per sample site in the region. It should be noted that missing data still represent bias, but these adjustments minimize the effect on estimation. For aggregation of the rural universe the sample site weights were adjusted to reflect the proportion of the 1975 census population residing in each region.

D. Age and Sex Distribution

Table 2 shows the distribution by age and sex of the 3,245 survey children for whom complete, reliable data are available, and who are included in the analyses, for the three rural regions combined (2,501) and for urban Sana'a (744). The male/female ratio for the rural regions is 1 to

0.81 (1385/1116) compared with 1 to 1.08 (357/387) for urban Sana'a. The lower proportion of male children in urban Sana'a is particularly evident in the youngest and the oldest age groups. In Appendix VII, the age and sex distribution of these survey children are shown for each of the four regions. The distribution of children by age and sex suggest moderate biases in representation by sex and individual months of age.

Table 1. Demographic Characteristics of Survey Sites by Region, Mean Values: Yemen 1979

Characteristics	Region				
	Tihama	Southern Highlands	Northern Highlands	Weighted Rural Yemen	Urban Sana'a
Number of Households	34.8	32.4	28.9	31.5	28.4
Total Persons	183.8	178.8	183.9	181.7	198.2
Persons per Household	5.3	5.6	6.4	5.8	7.0
Children[a] Identified	29.6	33.9	29.2	31.3	28.5
Children[a] Percent of Total Persons	16.1	19.0	15.9	17.4	14.4

[a] Ages 3-59 months

Table 2. Percentage Distribution of Survey Children by Age and Sex: Yemen 1979

COMBINED RURAL

Age in Months	Male	Female	Total[a]
3-5	6.6%	6.6%	6.6% (164)
6-11	14.1%	14.7%	14.4% (368)
12-17	14.6%	14.7%	14.6% (356)
18-23	11.7%	12.4%	12.0% (290)
24-35	21.9%	20.8%	21.4% (552)
36-47	19.5%	18.3%	19.0% (476)
48-59	11.6%	12.5%	12.0% (295)
Total	55.3% (1385)	44.7% (1116)	100.0% (2501)

URBAN SANA'A

Age in Months	Male	Female	Total[a]
3-5	4.8%	6.9%	5.9% (44)
6-11	15.2%	11.1%	13.1% (97)
12-17	13.5%	16.2%	14.9% (111)
18-23	8.1%	9.0%	8.6% (63)
24-35	28.1%	23.8%	25.9% (193)
36-47	19.0%	16.1%	17.5% (130)
48-59	11.3%	16.8%	14.2% (106)
Total	47.9% (357)	52.1% (387)	100.0% (744)

[a] Percentages are weighted based on population proportions. Actual number surveyed given in parentheses.

II. Anthropometry (Values of Height, Weight and Age Relationships)

A. Total Population

The distribution of survey children by reference deciles (equal 10 percent divisions of the centile distribution of the reference population) for each of the three anthropometric indices is presented in Table 3. Eighty one point four percent of survey children from the combined rural regions and 72.7 percent from urban Sana'a fall in the first height for age decile of the reference population. More than 70 percent of all Yemeni survey children are in this anthropometric category in which only 10 percent of the reference population children are found. Thirty-seven point nine percent of the rural children compared to 18.2 percent of the urban children are in the first weight for height decile of the reference population; 85.4 percent of rural children and 57.8 percent of urban children have similarly low values of weight for age. These skewed distributions in the survey population, particularly for the indices of height for age and weight for age, are so great that nearly two-thirds of the children from the combined rural regions are below the third centile of the reference population.

In populations such as Yemen's, in which large numbers of children are so far outside the centile range of the reference population, more useful and accurate classification can be made by using standard deviations than by using centiles.

Tables 4, 5 and 6 present the distributions of standard deviations from the reference mean of height for age, weight for height, and weight for age of Yemeni survey children in each of the four regions and in the three rural regions combined. In the tables, standard deviations below the reference mean are presented as negative numbers and those above the reference mean as positive numbers. Height for age and weight for height standard deviation distributions are shown graphically in Figures 3 and 4. It is evident that the height for age distribution is broader than the weight for height distribution and has a far greater percentage of values more than 2 standard deviations below the mean. It is also apparent that the prevalence of low values of all three indices is smaller in urban Sana'a than in the rural regions combined. Within the three rural regions, the prevalence of stunting (low height for age) is greatest in the Northern Highlands (70.6 percent) and smallest in the Tihama (51.8 percent) ($p < .001$). The prevalence of wasting (low weight for height) shows the opposite relationship between regions, with the smallest prevalence of values more than 2 standard deviations below the mean found in the Northern Highlands (7.0 percent) and the greatest prevalence by far in the Tihama (23.9 percent) ($p < .001$). In other words, the most stunted children are not the most wasted children. For these two indices the prevalences of low values in the

Southern Highlands have an intermediate position. The prevalences of low weight for age values are generally high and do not vary appreciably among the three rural regions (ranging between about 60 and 65 percent). As noted earlier, weight for age in effect combines stunting and wasting and cannot distinguish between them. Using this index alone one could not discern the considerable differences in the prevalences of stunting and wasting between the three rural regions.

The cross-tabulation of height for age and weight for height values, first suggested by Seoane and Latham (12) and later by Waterlow and Rutishauser (11), is a useful means of categorizing the anthropometric status of groups of children. Table 7 presents the observed prevalences of children with wasting only, stunting only, concurrent wasting and stunting, and neither (normal) in each of the four survey regions and in the three rural regions combined. The different prevalences of types of undernutrition between the three rural regions are apparent. Also apparent are the considerably lower prevalences of all three types of undernutrition in urban Sana'a than in the rural regions.

B. Age and Sex

Anthropometric data presented thus far have been for children of all ages and both sexes combined. In Table 8 observed percentages of survey children in the same four undernutrition categories are presented separately for male and female children, all ages combined, for the combined rural regions. The prevalence of concurrent stunting and wasting is somewhat higher among boys (7.1 percent) than girls (5.8 percent) ($.01 < p < .02$). In urban Sana'a, comparable prevalence rates are 2 percent for boys and less than 1 percent for girls.

The percentage distributions of standard deviations of height for age among male and female children, all ages combined, are shown in Figure 5 for the combined rural regions. Little difference is apparent between the sexes. Similar results are seen in the data from Urban Sana'a. Figure 6 presents similar distributions of weight for height. There is again little difference between boys and girls. Data from urban Sana'a is similar.

Table 9 shows prevalence rates for wasting only, stunting only, concurrent wasting and stunting, and normal, for both sexes combined, for the combined rural regions and for urban Sana'a by age. The prevalences of concurrent wasting and stunting are greatest in the second year of life, generally

the most vulnerable period for severe malnutrition in childhood. It is during this period that most children are being or have already been weaned from the breast and are not provided sufficient quantities of semi-solid foods. These data are presented graphically in Figure 7.

Table 3. Percentage Distribution of Survey Children by Centiles for Three Anthropometric Indices: Yemen 1979 (NCHS/CDC Reference)

COMBINED RURAL

Centile	Height-for-Age		Weight-for-Height		Weight-for-Age	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
0.0- 2.9	66.0		14.2		65.0	
0.0- 4.9	72.2		22.2		74.8	
0.0- 9.9	81.4	81.4	37.9	37.9	85.4	85.4
10.0-19.9	8.0	89.4	20.9	58.8	8.4	93.8
20.0-29.9	3.6	93.0	14.5	73.3	2.6	96.4
30.0-39.9	2.4	95.3	8.3	81.6	1.5	97.9
40.0-49.9	1.5	96.8	6.2	87.9	0.7	98.6
50.0-59.9	1.2	98.0	5.3	93.2	0.5	99.1
60.0-69.9	0.8	98.8	3.0	96.2	0.4	99.5
70.0-79.9	0.5	99.3	1.9	98.1	0.2	99.7
80.0-89.9	0.3	99.6	1.3	99.4	0.2	99.9
90.0-99.9	0.4	100.0	0.6	100.0	0.1	100.0
95.0-99.9	0.2		0.3		0.0	
97.0-99.9	0.2		0.2		-	
Actual Number Surveyed[a]	(2501)		(2501)		(2501)	

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Centile	Height-for-Age		Weight-for-Height		Weight-for-Age	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
0.0- 2.9	52.8		4.0		40.0	
0.0- 4.9	60.8		7.6		51.2	
0.0- 9.9	72.7	72.7	18.2	18.2	67.8	67.8
10.0-19.9	9.7	82.4	16.0	34.2	13.5	81.3
20.0-29.9	5.4	87.8	14.1	48.3	7.7	89.0
30.0-39.9	4.3	92.1	13.9	62.2	4.9	93.9
40.0-49.9	2.0	94.1	12.7	74.8	2.1	96.0
50.0-59.9	2.2	96.4	8.8	83.7	1.2	97.2
60.0-69.9	1.6	97.9	7.3	91.0	1.4	98.6
70.0-79.9	0.3	98.2	5.0	95.9	0.5	99.2
80.0-89.9	0.8	99.0	2.0	98.0	0.4	99.6
90.0-99.9	1.0	100.0	2.0	100.0	0.4	100.0
95.0-99.9	0.7		0.8		0.1	
97.0-99.9	0.7		0.4		0.1	
Actual Number Surveyed[a]	(744)		(744)		(744)	

[a] Percentages are weighted based on population proportions.

Table 4. Percentage Distribution of Survey Children by Height-for-Age Standard Deviations by Region: Yemen 1979 (NCHS/CDC Reference)

Height-for-Age Standard Deviations	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
-6.00 to -5.01	1.2	1.2	1.5	1.5	1.4	1.4	1.4	1.4	1.2	1.2
-5.00 to -4.51	1.2	2.4	2.6	4.1	2.7	4.1	2.4	3.8	1.4	2.6
-4.50 to -4.01	2.8	5.2	4.2	8.3	6.6	10.7	4.8	8.6	2.4	4.9
-4.00 to -3.51	5.5	10.7	8.0	16.3	10.1	20.8	8.3	16.9	5.1	10.1
-3.50 to -3.01	11.1	21.8	9.4	25.7	14.8	35.7	11.6	28.5	10.9	21.0
-3.00 to -2.51	12.5	34.3	15.4	41.1	17.8	53.4	15.7	44.3	13.2	34.2
-2.50 to -2.01	17.6	51.8	19.6	60.6	17.2	70.6	18.4	62.7	14.2	48.4
-2.00 to -1.51	13.9	65.7	14.9	75.6	12.2	82.8	13.8	76.5	17.7	66.1
-1.50 to -1.01	14.0	79.7	11.6	87.2	6.7	89.6	10.3	86.8	14.3	80.3
-1.00 to - .51	9.0	88.7	6.7	93.9	5.3	94.9	6.6	93.3	7.9	88.2
- .50 to - .01	5.2	93.9	3.5	97.4	2.6	97.4	3.5	96.8	5.9	94.1
.00 to + .50	4.5	98.4	1.5	98.9	1.4	98.8	2.0	98.8	3.7	97.8
+ .51 to +1.00	.9	99.2	.7	99.6	.8	99.6	.8	99.5	1.1	98.9
+1.01 or more	.8	100.0	.4	100.0	.4	100.0	.5	100.0	1.1	100.0
Actual Number Surveyed[a]	(819)		(970)		(712)		(2501)		(744)	

[a] Percentages are weighted based on population proportions.

Table 5. Percentage Distributions of Survey Children by Weight-for-Height Standard Deviations, by Region: Yemen 1979 (NCHS/CDC Reference)

Weight-for-Height Standard Deviations	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
-6.00 to -3.01	2.5	2.5	.7	.7	.9	.9	1.1	1.1	.1	.1
-3.00 to -2.51	5.9	8.3	1.9	2.6	1.4	2.3	2.4	3.5	.7	.8
-2.50 to -2.01	15.5	23.9	6.6	9.2	4.7	7.0	7.4	10.9	2.5	3.4
-2.00 to -1.51	21.7	45.6	19.5	28.7	12.1	19.2	17.3	28.2	7.8	11.2
-1.50 to -1.01	21.5	67.1	25.4	54.1	21.7	40.9	23.4	51.6	15.8	27.0
-1.00 to -0.51	18.9	86.0	21.3	75.4	26.5	67.3	22.7	74.3	21.9	48.9
-0.50 to -0.01	8.9	94.8	13.2	88.6	16.1	83.5	13.5	87.8	25.7	74.6
.00 to + .50	3.8	98.6	8.4	97.0	10.3	93.8	8.3	96.1	16.1	90.7
+ .51 to +1.00	1.1	99.7	1.9	98.9	4.0	97.8	2.5	98.6	6.3	97.0
+1.01 to +1.50	-	99.7	.8	99.7	1.8	99.6	1.0	99.7	1.6	98.6
+1.51 or more	.3	100.0	.3	100.0	.4	100.0	.3	100.0	1.4	100.0
Actual Number Surveyed[a]	(819)		(970)		(712)		(2501)		(744)	

[a] Percentages are weighted based on population proportions.

Table 6. Percentage Distribution of Survey Children by Weight-for-Age Standard Deviations by Region: Yemen 1979 (NCHS/CDC Reference)

Weight-for-Age Standard Deviations	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
-6.00 to -5.01	1.1	1.1	.5	.5	.1	.1	.5	.5	-	-
-5.00 to -4.51	2.5	3.6	.2	1.7	.7	.8	1.2	1.7	.7	.7
-4.50 to -4.01	6.5	10.1	4.8	6.5	5.7	6.5	5.4	7.1	.9	1.6
-4.00 to -3.51	13.7	23.8	11.6	18.1	10.5	17.0	11.6	18.7	4.8	6.4
-3.50 to -3.01	18.8	42.6	19.3	37.4	18.7	35.8	19.0	37.7	11.0	17.5
-3.00 to -2.51	22.0	64.6	22.3	59.6	25.8	61.6	23.5	61.2	18.0	35.5
-2.50 to -2.01	15.6	80.2	18.3	77.9	18.1	79.7	17.8	78.9	22.9	58.4
-2.00 to -1.51	10.7	91.0	13.5	91.4	11.5	91.2	12.3	91.2	18.0	76.4
-1.50 to -1.01	5.6	96.6	5.4	96.7	5.5	96.7	5.5	96.7	13.4	89.8
-1.00 to - .51	2.3	98.9	1.8	98.5	2.0	98.7	1.9	98.6	6.2	96.0
- .50 to - .01	.8	99.7	1.0	99.5	.7	99.4	.8	99.5	2.6	98.6
.00 to + .50	.3	100.0	.4	99.9	.4	99.8	.4	99.9	.7	99.3
+ .51 or more	-	100.0	.1	100.0	.2	100.0	.1	100.0	.7	100.0
Actual Number Surveyed[a]	(819)		(970)		(712)		(2501)		(744)	

[a] Percentages are weighted based on population proportions.

FIGURE 3. DISTRIBUTION OF SURVEY CHILDREN BY HEIGHT FOR AGE STANDARD DEVIATIONS, COMBINED RURAL VS URBAN SANA'A YEMEN 1979 (NCHS/CDC REFERENCE)

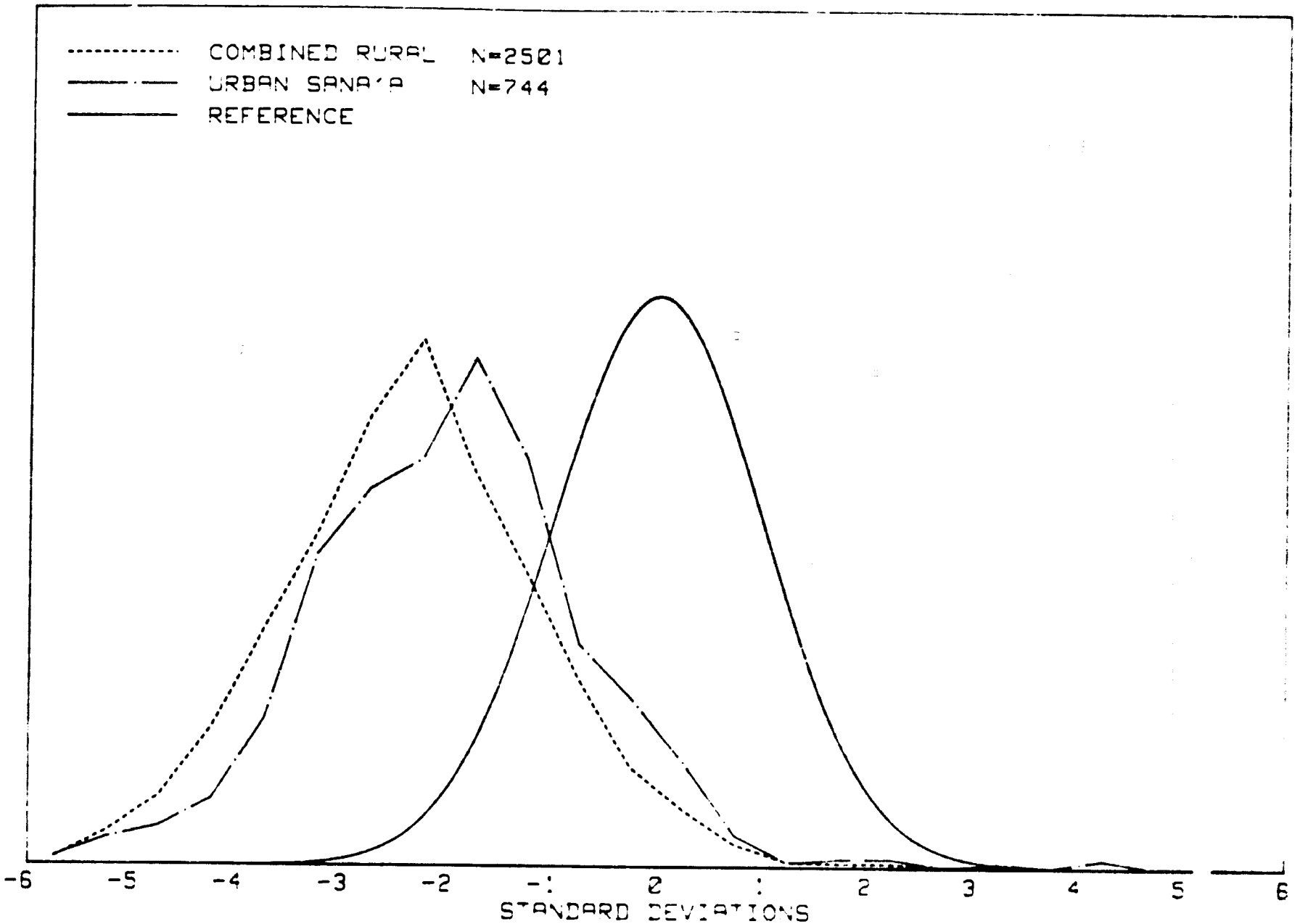

FIGURE 4. DISTRIBUTION OF SURVEY CHILDREN BY WEIGHT FOR HEIGHT STANDARD DEVIATIONS, COMBINED RURAL VS URBAN SANA'A YEMEN 1979 (NCHS/CDC REFERENCE)

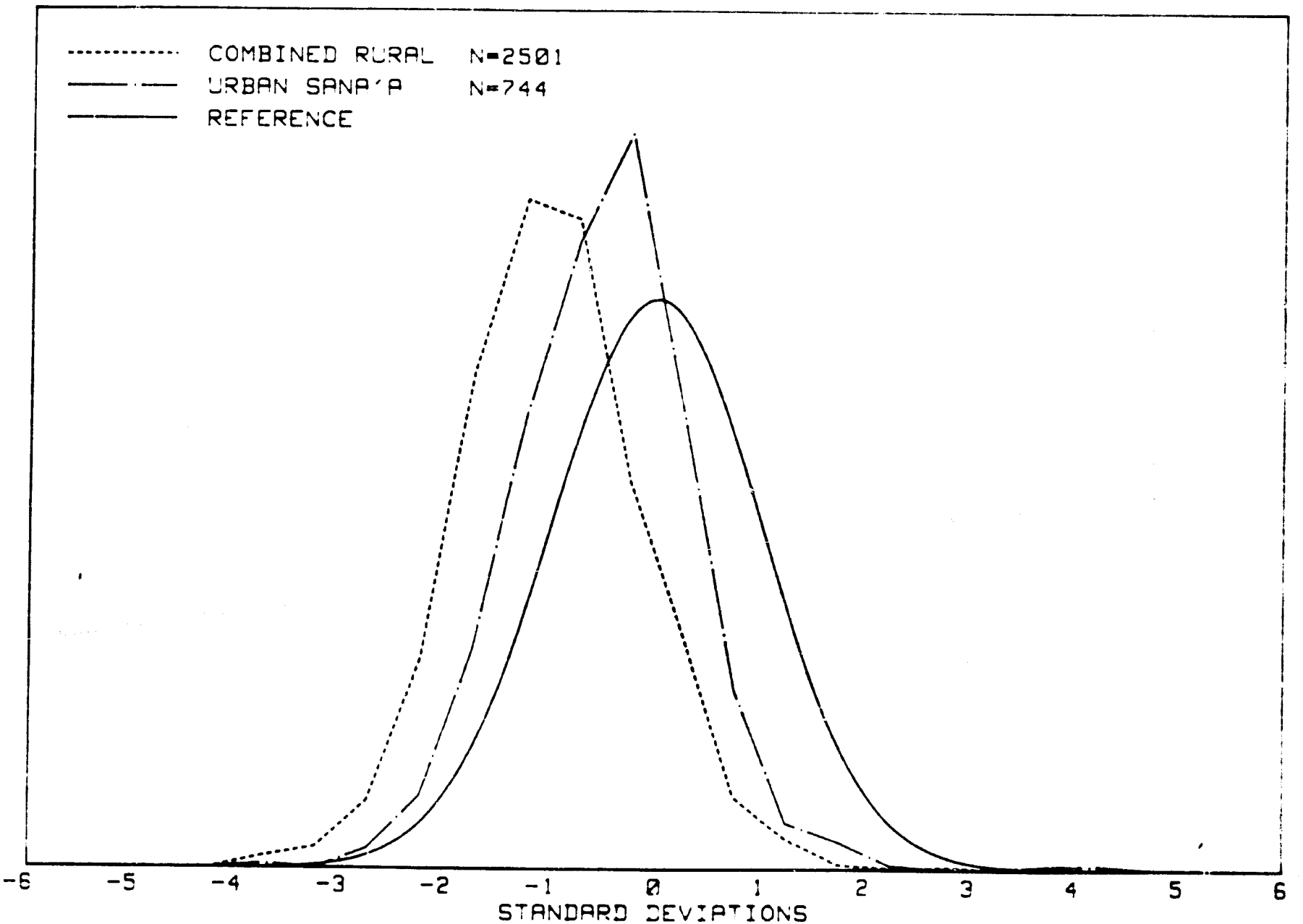

Table 7. Percentage Distribution of Survey Children by Waterlow Classes by Region: Yemen 1979 (NCHS/CDC Reference)

Region	Waterlow Class[a]				
	Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]
Tihama	11.0%	38.9%	12.9%	37.2%	100.0% (819)
Southern Highlands	3.2%	54.7%	6.0%	36.2%	100.0% (970)
Northern Highlands	2.9%	66.4%	4.2%	26.5%	100.0% (712)
Combined Rural	4.4%	56.2%	6.5%	32.9%	100.0% (2501)
Urban Sana'a	2.1%	47.2%	1.2%	49.5%	100.0% (744)

[a] Wasting only: Weight for Height more than 2 standard deviations below the mean, and Height for Age not more than 2 standard deviations below the mean.
Stunting only: Height for Age more than 2 standard deviations below the mean, and Weight for Height not more than 2 standard deviations below the mean.
Wasting & Stunting: Weight for Height and Height for Age more than 2 standard deviations below the mean.

[b] Actual number surveyed given in parentheses. Percentages are weighted based on population proportions.

Table 8. Percentage Distribution of Survey Children by Waterlow Classes by Sex: Yemen 1979 (NCFS/CDC Reference)

COMBINED RURAL

	Waterlow Class[a]				
	Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]
Male	4.4%	56.8%	7.1%	31.7%	100.0% (1385)
Female	4.5%	55.4%	5.8%	34.3%	100.0% (1116)
Total	4.4%	56.2%	6.5%	32.9%	100.0% (2501)

[a] Wasting only: Weight for Height more than 2 standard deviations below the mean, and Height for Age not more than 2 standard deviations below the mean.
Stunting only: Height for Age more than 2 standard deviations below the mean, and Weight for Height not more than 2 standard deviations below the mean.
Wasting and Stunting: Weight for Height and Height for Age more than 2 standard deviations below the mean.

[b] Actual number surveyed given in parentheses. Percentages are weighted based on population proportions.

FIGURE 5. DISTRIBUTION OF SURVEY CHILDREN BY HEIGHT FOR AGE STANDARD DEVIATIONS BY SEX, COMBINED RURAL YEMEN 1979 (NCHS/CDC REFERENCE)

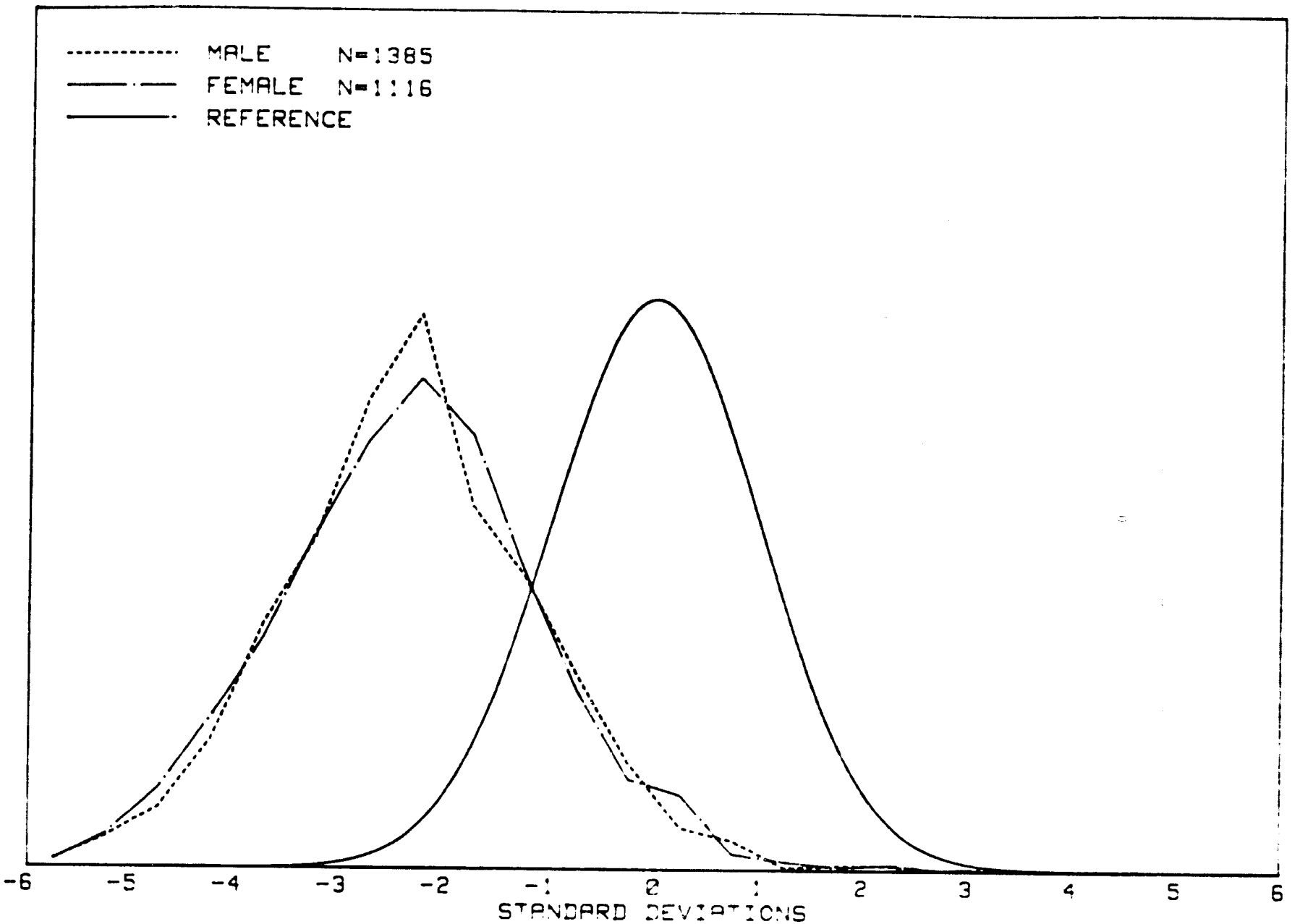

FIGURE 6. DISTRIBUTION OF SURVEY CHILDREN BY WEIGHT FOR HEIGHT STANDARD DEVIATIONS BY SEX, COMBINED RURAL YEMEN 1979 (NCHS/CDC REFERENCE)

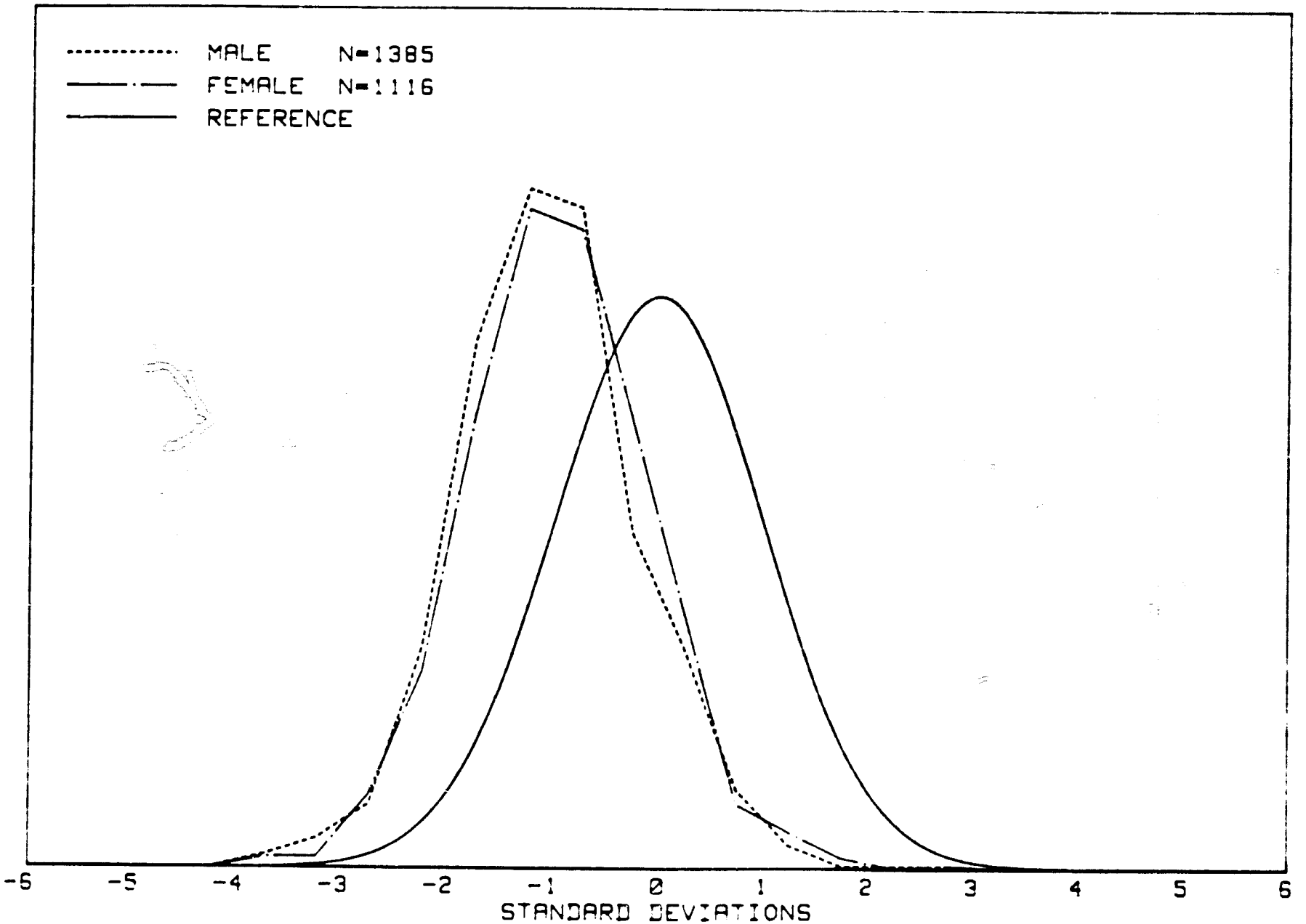

Table 9. Percentage Distribution of Survey Children by Waterlow Classes, by Age: Yemen 1979 (NCHS/CDC Reference)

COMBINED RURAL

Age in Months	Waterlow Class[a] Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]	
3-5	3%	25%	1%	74%	100%	(164)
6-11	4%	47%	5%	44%	100%	(368)
12-17	5%	50%	9%	36%	100%	(356)
18-23	5%	60%	15%	20%	100%	(290)
24-35	5%	58%	5%	32%	100%	(552)
36-47	3%	68%	5%	24%	100%	(476)
48-59	5%	67%	6%	22%	100%	(295)
Total	4%	56%	7%	33%	100%	(2501)

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Age in Months	Waterlow Class[a] Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]	
3-5	5%	33%	-	62%	100%	(44)[c]
6-11	3%	31%	1%	65%	100%	(97)
12-17	6%	37%	2%	56%	100%	(111)
18-23	-	56%	1%	43%	100%	(63)
24-35	2%	44%	1%	53%	100%	(193)
36-47	-	56%	1%	43%	100%	(130)
48-59	1%	69%	2%	28%	100%	(106)
Total	2%	47%	1%	50%	100%	(744)

[a] Wasting only: Weight for Height more than 2 standard deviations below the mean, and Height for Age not more than 2 standard deviations below the mean.

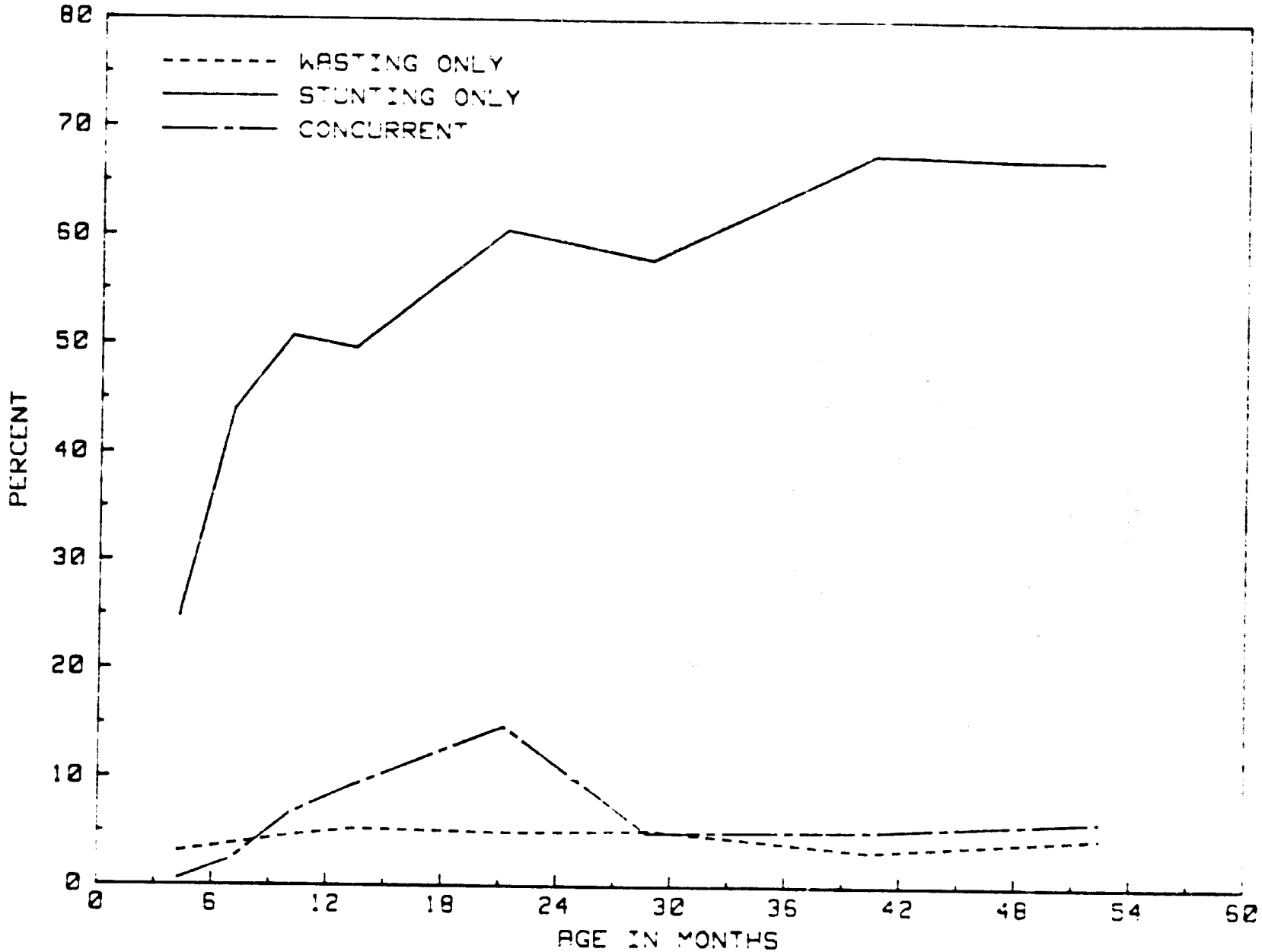
Stunting only: Height for Age more than 2 standard deviations below the mean, and Weight for Height not more than 2 standard deviations below the mean.

Wasting & Stunting: Weight for Height and Height for Age more than 2 standard deviations below the mean.

[b] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

[c] N less than 50 is considered statistically unreliable.

FIGURE 7. PREVALENCE OF WASTING ONLY, STUNTING ONLY, AND CONCURRENT WASTING AND STUNTING, COMBINED RURAL YEMEN 1979 (NCHS/CDC REFERENCE)



III. Hemoglobin

Four-hundred and twenty-six children in the combined rural regions and 135 in urban Sana'a had valid determinations of hemoglobin performed and were included in the analyses. Because of difficulty in obtaining blood samples the data presented in this section are incomplete and should not be considered a valid subsample of the total population.

Because hemoglobin concentration normally increases somewhat with altitude, observed values have been adjusted by subtracting 0.2 g/dl from values of persons residing between 2,500 and 5,000 feet altitude, 0.4 g/dl from those between 5,000 and 7,500 feet, and 0.6 g/dl from those over 7,500 feet, as proposed by Sauberlich (13).

The distributions of hemoglobin values are shown in Table 10. Among the three rural regions, the Tihama has by far the greatest prevalence of low values (82 percent). The prevalence of low values is much smaller in urban Sana'a (17 percent) than in the other rural regions (53 and 47 percent).

Anemia prevalence by age categories reveals that in the rural regions, children from 6 to 24 months of age have the greatest prevalences, with the prevalences decreasing progressively from 2 to 5 years of age. In urban Sana'a prevalences are much smaller, but the number of children examined was insufficient to provide adequate rates by age.

Anemia prevalences among male and female children are practically identical in all age groups and in all regions.

No relationships could be detected between the four Waterlow classes (normal, wasting only, stunting only, and wasting and stunting) and the prevalence of anemia. The number of children falling into the abnormal categories did not permit computation of reliable rates.

Table 11 presents the hemoglobin distribution for the 397 rural mothers and 128 urban mothers on whom reliable determinations were performed and whose data were analyzed. In general, in the four survey regions, the patterns for mothers are much like those of children, with a much higher prevalence of low hemoglobin levels in the rural regions, particularly in the Tihama, than in urban Sana'a.

Since hemoglobin levels normally fall during pregnancy, a cut-off level of 11.0 g/dl has been employed in determining prevalence of anemia for pregnant women. For all other women, lactating or non-lactating, a level of 12.0 g/dl has been employed. Overall prevalence of anemia among survey mothers, using appropriate cut-off levels (see above), varies from a high of 72 percent in the Tihama to a low of 5 percent in urban Sana'a. The anemia rate was 31 percent in the Southern Highlands, 27 percent in the Northern Highlands, and 36 percent for the combined rural.

Table 10. Percentage Distribution of Survey Children by Hemoglobin Values by Region: Yemen 1979

Hgb Value	Region: Tihama	Southern Highlands	Northern Highlands	Combined Rural	Urban Sana'a
<7.0	13%	5%	3%	6%	-
7.0- 7.4	7%	3%	2%	3%	1%
7.5- 7.9	9%	3%	6%	5%	-
<8.0	29%	12%	12%	15%	1%
8.0- 8.4	4%	2%	2%	2%	1%
8.5- 8.9	10%	7%	5%	7%	2%
8.0- 8.9	14%	9%	6%	9%	3%
9.0- 9.4	9%	8%	6%	8%	-
9.5- 9.9	11%	8%	5%	7%	2%
9.0- 9.9	20%	16%	12%	15%	2%
10.0-10.4	10%	10%	7%	9%	4%
10.5-10.9	9%	6%	10%	8%	7%
10.0-10-9	20%	17%	17%	17%	11%
11.0 & greater	18%	47%	53%	44%	83%
11.0-11.4	4%	11%	8%	9%	13%
11.5-11.9	6%	13%	10%	11%	6%
12.0-12.4	4%	11%	10%	10%	18%
12.5-12.9	4%	4%	8%	5%	12%
13.0 & greater	-	7%	18%	9%	33%
Total[a]	100% (135)	100% (174)	100% (117)	100% (426)	100% (135)

[a] Percentages are weighted based on population proportions. Actual number surveyed given in parentheses.

Table 11. Percentage Distribution of Survey Children's Mothers' Hemoglobin Values by Region: Yemen 1979

Hgb Value	Region				
	Tihama	Southern Highlands	Northern Highlands	Combined Rural	Urban Sana'a
<8.0	8%	1%	3%	3%	-
8.0- 8.9	8%	3%	1%	3%	-
9.0- 9.9	10%	4%	4%	5%	1%
10.0-10.9	23%	11%	10%	13%	2%
11.0-11.9	27%	19%	15%	19%	6%
12.0 & greater	24%	62%	68%	58%	91%
Total[a]	100% (127)	100% (162)	100% (108)	100% (397)	100% (128)

[a] Percentages are weighted based on population proportions. Actual number surveyed given in parentheses.

IV. Dietary

The dietary intake data was collected using a simplified dietary methodology developed by a panel convened by the Committee on International Programs of the U.S. National Academy of Sciences (NAS). Because of subsampling methodology and small numbers, particularly in urban Sana'a, minor differences in the prevalence of consumption of breast milk may exist between some of the tables in this section.

In 80 percent of the households the mother of the survey child was the respondent for the dietary interview. In the mother's absence, dietary information was provided by a sibling, the head of household, or a relative of the head of household.

Table 12 presents urban and rural data on the duration of breast-feeding of survey children by age, socioeconomic status (as evidenced by father's literacy) and the presence of electricity in the home (rural only). Children of illiterate fathers are breast fed longer as are those in houses without electricity. The median age of weaning among urban children (5.6 months) is much earlier than among rural children (12.7 months) ($p < .001$).

Fifty-four percent of survey mothers in the combined rural regions were lactating (breast-feeding any child), while the proportion of such women in urban Sana'a was half as great (27.3 percent) ($p < .001$).

Table 13 shows the portion of urban and rural children being breast fed by age. By 6 months of age 17 percent of rural children and 39 percent of urban children are no longer breast-feeding. At 12 to 15 months of age 57 percent of rural children and 23 percent of urban children are still breast-feeding.

Table 14 gives the percent and number of children consuming milk products and weaning foods in the combined rural region for the dietary questionnaire. The types of milks most commonly consumed by children 3-30 months of age were (1) breast milk, (2) powdered dry milks (Nono, Nido and Family Milk), and (3) other fluid milks (cow, goat, sheep and camel milks). The consumption of other fluid milks increased from 30 percent among children 3-5 months of age to 49 percent among those 24-30 months of age. Among those 3-5 months, the prevalence of breast milk consumption was 95 percent and dropped to 17 percent among those 24-30 months of age.

In Table 15 prevalences are given for the same food categories for children 3-30 months of age in urban Sanā'a. As in the rural areas breast milk, and Nono, Nido and Family Milks are the major sources of milk for the young child. In the urban region, other fluid milks (cow, goat, sheep and camel milks) were consumed infrequently; only 4 percent consumed these types of milk. Urban children consumed more proprietary formula (10 percent) and evaporated milk (12 percent) than the children in the rural areas

where they consumed 3 percent and 8 percent, respectively. The overall prevalence of Nono, Nido, and Family Milk consumption was 43 percent among rural children and 64 percent among urban children.

The use of semi-solid, traditional weaning foods such as asid, maded, harish, malalabia, and shabaza and non-traditional weaning foods such as Cerelac, baby biscuits varied somewhat unexpectedly between the rural regions and urban Sana'a. In the rural regions, traditional weaning foods were consumed by 19 percent of children while in urban Sana'a they were consumed by a considerably larger proportion of the population, 37 percent. The consumption of non-traditional weaning foods, was very low in the rural regions (2 percent) and negligible in urban Sana'a. Among rural children, the consumption of traditional weaning foods increased with age; 3 percent of the children 3-5 months consumed these foods while 26 percent of those 24-30 months consumed them. Most of the traditional weaning foods are items which adults and older children also consume.

Table 16 gives the prevalences of 12 major food groups which were consumed by the survey children and their families in the rural regions and urban Sana'a. For example, grains were consumed by 99 percent of urban families, and legumes by 88 percent. Among rural families grains were consumed by a proportion (97 percent) similar to urban families yet legumes were consumed by a far

smaller proportion (26 percent). For children, the consumption of grains was 72 percent and 68 percent in urban and rural regions respectively. Children's consumption of legumes was much lower, 39 percent in urban Sana'a, and only 10 percent in the rural regions.

In rural areas, other items which were consumed frequently by children and family members alike were: other milks, beverages, other fruit, and poultry and root crops. Nearly the same patterns were seen in urban Sana'a: beverages, other fruits, poultry and root crops were consumed at relatively high rates both by children, and family members. None of the major food groups were consumed by children only and not by other family members. The examination of of these data to identify possible "taboo" foods for the child (e.g. foods consumed by the family but not fed to the child) shows that fish, legumes, vegetables, other vegetables, and fruits were consumed appreciably by family members, but were relatively uncommon in children's diets.

Qat, Catha edulis, is a small tree which is cultivated as a cash crop. The leaves of this tree are chewed by men and women in the afternoon hours during relaxation and socializing. An analysis of 100 grams of qat shows it has 18.5 milligrams iron, 290 milligrams calcium, and 130-160 milligrams of ascorbic acid. Qat causes anorexia, insomnia, and constipation. It has an amphetamine-like action and some persons use it for appetite

control and to increase physical activity. Although the use of qat has social and cultural tradition, females do not use it as much as males. Among females 38 percent used qat while among other family members, presumably, 61 percent used qat. The relationship of qat consumption to nutritional status in the survey population is unknown.

Table 12. Duration of Breast-Feeding of Survey Children by Age of Child and Demographic Characteristics: Yemen 1979

	Median Length of Breast-Feeding in Months	Proportion Still Being Breast-Fed At:		
		6 Months	12 Months	24 Months
COMBINED RURAL	12.7 (2490)	76%	55%	18%
Father Illiterate	14.0 (1462)	80%	60%	20%
Father Literate	11.0 (1001)	71%	48%	14%
Electricity	9.9 (779)	56%	44%	13%
No Electricity	14.4 (1713)	82%	62%	20%
URBAN SANA'A	5.6 (743)	54%	24%	4%
Father Illiterate	7.8 (183)	59%	35%	9%
Father Literate	4.7 (559)	46%	21%	3%

Table 13. Age Distribution of Survey Children by Breast-Feeding Status at the Time of the Survey: Yemen 1979

COMBINED RURAL

Age in Months	Breast-Feeding	Not Breast-Feeding	Total[a]
3-5	83.1%	16.9%	100.0% (164)
6-8	69.7%	30.3%	100.0% (185)
9-11	64.4%	35.6%	100.0% (182)
12-14	56.1%	43.9%	100.0% (229)
15-17	35.7%	64.3%	100.0% (127)
18-23	24.6%	75.4%	100.0% (288)
24-35	7.4%	92.6%	100.0% (550)
36-47	3.5%	96.5%	100.0% (471)
48-59	1.3%	98.7%	100.0% (294)
Total	27.7% (720)	72.3% (1770)	100.0% (2490)

URBAN SANA'A

Age in Months	Breast-Feeding	Not Breast-Feeding	Total[a]
3-5	61.2%	38.8%	100.0% (44)
6-8	39.2%	60.8%	100.0% (55)
9-11	26.4%	73.6%	100.0% (42)
12-14	22.4%	77.6%	100.0% (70)
15-17	9.5%	90.5%	100.0% (41)
18-23	6.4%	93.6%	100.0% (63)
24-35	2.1%	97.9%	100.0% (193)
36-47	0.7%	99.3%	100.0% (130)
48-59	-	100.0%	100.0% (105)
Total	11.9% (89)	88.1% (654)	100.0% (743)

[a]Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

Table 14. Prevalence of Consumption of Individual Food Items by Survey Children, by Age and Region: Yemen, 1979

COMBINED RURAL

Food Item	Age in Months							
	3-5	6-8	9-11	12-14	15-17	18-23	24-30	Total[a]
Breast Milk	95% (73)	74% (83)	66% (85)	62% (108)	43% (60)	39% (135)	17% (151)	51% (695)
Nono, Nido, Family Milk	43% (73)	47% (83)	51% (85)	45% (108)	63% (59)	43% (134)	29% (151)	43% (693)
Formula:SMA, Mornigaga	8% (73)	4% (83)	6% (85)	1% (108)	- (60)	2% (134)	1% (151)	3% (694)
Cow, Goat, Sheep and Camel Milks	30% (73)	32% (83)	39% (85)	46% (108)	42% (60)	40% (134)	49% (151)	41% (693)
Yogurt, Sour Milk, Cheese	3% (73)	7% (83)	20% (85)	28% (108)	42% (60)	36% (135)	46% (150)	28% (694)
Evaporated Milk	- (73)	5% (83)	6% (85)	7% (108)	12% (60)	12% (135)	9% (151)	8% (695)
Baby Biscuits	5% (73)	8% (83)	6% (85)	5% (107)	13% (60)	7% (135)	7% (151)	7% (694)
Cerelac	4% (73)	6% (83)	6% (85)	7% (108)	7% (60)	5% 135)	5% (151)	6% (695)
Traditional Weaning Foods	3% (73)	10% (83)	12% (85)	24% (107)	23% (60)	22% (135)	26% (150)	19% (693)
Non-Traditional Weaning Foods	- (73)	1% (82)	2% (85)	2% (108)	3% (60)	4% (135)	- (150)	2% (693)

[a] Actual number surveyed given in parentheses.

Table 15. Prevalence of Consumption of Individual Food Items by Survey Children, by Age and Region: Yemen, 1979

URBAN SANA'A[a]

Food Items	Age in Months				
	3-8 mos.	9-14 mos.	15-23 mos.	24-30 mos.	Total[b]
Breast Milk	61% (41)	47% (62)	29% (48)	10% (57)	36% (208)
Nono, Nido, Family Milk	56% (41)	69% (62)	75% (48)	53% (57)	64% (208)
Formula:SMA, Mornigaga	22% (41)	8% (62)	8% (48)	5% (57)	10% (208)
Cow, Goat, Sheep and Camel Milks	- (41)	5% (62)	4% (47)	5% (57)	4% (207)
Yogurt, Sour Milk, Cheese	2% (41)	11% (62)	22% (46)	14% (57)	13% (206)
Evaporated Milk	15% (41)	5% (62)	15% (46)	14% (57)	12% (206)
Baby Biscuits	24% (41)	12% (61)	4% (48)	- (57%	9% (207)
Cerelac	49% (41)	32% (62)	21% (48)	23% (57)	30% (208)
Traditional Weaning Foods	10% (41)	48% (62)	21% (47)	58% (57)	37% (207)
Non-Traditional Weaning Foods	- (41)	- (62)	2% (47)	- (55)	1% (205)

[a]Note: N <50 considered statistically unreliable.

[b]Actual number surveyed given in parentheses.

Table 16. Prevalence of Consumption of Major Food Groups by Survey Children 3-30 Months of Age and Their Families, by Region: Yemen, 1979

Food Group	Survey Children				Survey Children's Families			
	Combined Rural		Urban Sana'a		Combined Rural		Urban Sana'a	
	Percent	Number Surveyed	Percent	Number Surveyed	Percent	Number Surveyed	Percent	Number Surveyed
Eggs	6%	(691)	13%	(203)	8%	(690)	14%	(208)
Root Crops	7%	(695)	60%	(208)	8%	(695)	73%	(208)
Grains	58%	(695)	72%	(208)	97%	(695)	99%	(208)
Fruits	8%	(695)	17%	(208)	16%	(695)	27%	(208)
Vegetables	13%	(695)	20%	(208)	84%	(695)	89%	(208)
Milk Products	28%	(694)	13%	(206)	63%	(693)	34%	(208)
Milks	47%	(695)	15%	(208)	39%	(695)	26%	(208)
Other Beverages	71%	(695)	65%	(208)	98%	(691)	97%	(208)
Meats	14%	(695)	29%	(208)	26%	(695)	60%	(208)
Fish	16%	(695)	2%	(208)	35%	(695)	6%	(208)
Poultry	7%	(695)	22%	(208)	12%	(695)	38%	(208)
Legumes	10%	(695)	39%	(208)	26%	(695)	88%	(208)

V. Other Associations

Other variables, carefully observed and recorded by the Yemen survey team members, may be associated in varying degree with the chronic and acute undernutrition and the anemia which have been documented. The nature and strength of certain of these associations may shed light on possible reasons for the magnitude and distribution of the malnutrition observed, and may suggest possible avenues for intervention to improve the nutritional status of Yemeni children and their families.

Associations of three indicators of fathers socioeconomic status with stunting and anemia in their children are shown in Tables 17 and 18 for the combined rural regions and urban Sana'a. The three indicators are father's literacy, occupation, and work location.

In the rural regions there is no apparent relationship between either stunting or anemia and whether the father could or could not read or write. In urban Sana'a, where a higher proportion of fathers were literate (75.2 percent) than in the rural regions (45.3 percent), both stunting (p .001) and anemia were considerably less prevalent in children of literate fathers. In the rural regions farmers of more than 5 feddans had fewer stunted children but more enemic children than those farming smaller areas. In Sana'a, skilled workers had fewer stunted children than unskilled workers, but there was no appreciable difference in anemia prevalence between these two groups.

Table 19 shows illness, fever, and diarrhea prevalence rates, among rural children in each of the four Waterlow anthropometric classes. Information regarding illness, fever, and diarrhea was collected. For illness, fever, and diarrhea, children with wasting and concurrent stunting and wasting have appreciably higher prevalence rates than normal children (p .001). For the symptom of diarrhea, children in each of the three abnormal Waterlow classes have somewhat higher rates than normal children. Among stunted children the prevalence of illness, fever or diarrhea was similar to that among normal children.

The presence or absence of physical signs of three nutritionally-related clinical conditions was determined on examination of the survey children. These were (1) edema (swelling) of the lower legs, suggestive of the severe form of protein-energy malnutrition known as kwashiorkor, (2) angular stomatitis (redness and cracking at the angle of the mouth) suggestive of riboflavin deficiency (vitamin B_2), and (3) five signs of bone deformity suggestive of rickets (vitamin D deficiency).

Kwashiorkor is readily ruled out as a public health problem among Yemeni children at the time of this survey. Of the 3,245 children on whom usable data were available, only one was found to have bilateral pretibial edema.

Riboflavin deficiency, as evidenced by angular stomatitis, is almost as rare among the survey population. Only 18 children, less than one percent of the total, were found to have this clinical sign.

Signs suggestive of rickets were somewhat more prevalent and are presented in Table 20. Most common was frontal bossing (abnormal prominence of the forehead), with an overall rate of 11.7 percent in the combined rural regions and 5.8 percent in Sana'a ($p < .001$).

No relationships between nutritional status, as defined by Waterlow class, and prevalence of vitamin D signs were detected.

Rickets, rather than being primarily a dietary deficiency of vitamin D, is more likely to be caused by inadequate exposure to sunlight. Sunlight, through the action of ultraviolet light upon the skin, is capable of producing vitamin D within the body from precursors of vitamin D which are present in many common foods. In Yemen, as in certain other Middle East nations, the cultural pattern of overly protecting young children from the sun's rays by excessive clothing is probably a major cause of the moderate prevalence of observed clinical signs consistent with rickets.

Table 17. Percent Prevalence of Stunting[a] in Survey Children, by Father's Socioeconomic Status: Yemen 1979

COMBINED RURAL REGIONS			URBAN SANA'A		
Status of Father	Percent of Fathers	Percent Stunting	Status of Father	Percent of Fathers	Percent Stunting
Can Father Read or Write					
Yes	45.3	64	Yes	75.2	45
No	54.7	62	No	24.8	57
Total	100.0 (2463)	63	Total	100.0 (742)	48
Full-Time Occupation					
Large Farmer	6.6	51	Skilled	78.3	56
Small Farmer	93.4	66	Unskilled	21.7	65
Total	100.0 (1040)	65	Total	100.0 (296)	58
Working In or Out of Yemen					
In	81.3	64	In	97.8	49
Out	18.7	58	Out	2.2	55
Total	100.0 (2280)	63	Total	100.0 (615)	49

[a] Height for Age more than 2 standard deviations below the mean.

Table 18. Percent Prevalence of Anemia[a] in Survey Children, by Father's Socioeconomic Status: Yemen 1979

COMBINED RURAL REGIONS			URBAN SANA'A		
Status of Father	Percent of Fathers	Percent Anemic	Status of Father	Percent of Fathers	Percent Anemic
Can Father Read or Write					
Yes	44.7	56	Yes	78.1	14
No	55.3	56	No	21.9	28
Total	100.0 (423)	56	Total	100.0 (135)	17
Full-Time Occupation					
Large Farmer	6.9	62	Skilled	81.6	20
Small Farmer	93.1	53	Unskilled	18.4	21
Total	100.0 (179)	54	Total	100.0 (48)	20
Working In or Out of Yemen					
In	79.5	55	In	99.2	18
Out	20.5	56	Out	0.8	-
Total	100.0 (393)	55	Total	100.0 (117)	18

[a] Hemoglobin less than 11.0 g/dl

Table 19. Prevalence of Illness, Fever, and Diarrhea, by Waterlow Class: Yemen 1979 (NCHS/CDC Reference)

COMBINED RURAL REGIONS

Waterlow Class[a]	Prevalence		
	Illness	Fever	Diarrhea
Wasting Only (N = 138)[b]	16%	22%	23%
Stunting Only (N = 1311)	12%	19%	16%
Stunting & Wasting (N = 195)	22%	31%	22%
Normal (N = 842)	12%	19%	14%
Total (N=2486)	13%	20%	16%

[a] Wasting only: Weight for Height more than 2 standard deviations below the mean, and Height for Age not more than 2 standard deviations below the mean.
Stunting only: Height for Age more than 2 standard deviations below the mean, and Weight for Height not more than 2 standard deviations below the mean.
Wasting & Stunting: Weight for Height and Height for Age more than 2 standard deviations below the mean.

[b] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

Table 20. Prevalence of Vitamin D Deficiency Associated Signs in Survey Children by Region: Yemen 1979

Clinical Signs	Region: Tihama	Southern Highlands	Northern Highlands	Combined Rural	Urban Sana'a
Frontal Bossing (Children 3-59 months of age)[a]	14.0% (812)	9.3% (946)	13.7% (707)	11.7% (2465)	5.8% (741)
Wrist Deformity (Children 3-59 months of age)[a]	0.8% (812)	0.6% (946)	0.6% (707)	0.6% (2465)	- (741)
Chest Deformity (Children 3-59 months of age)[a]	3.2% (812)	1.4% (946)	1.6% (707)	1.8% (2465)	0.3% (741)
Leg Deformity (Children 12-59 months of age)[a]	4.2% (630)	1.8% (742)	2.6% (552)	2.5% (1924)	1.5% (592)
Open Anterior Fontanel (Children 24-59 months of age)[a]	1.6% (445)	1.7% (482)	3.4% (370)	2.3% (1297)	0.2% (429)

[a] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

SUMMARY AND CONCLUSIONS

The prevalence of each of the two common forms of protein-energy malnutrition: (1) acute undernutrition (wasting), and (2) chronic undernutrition (stunting), was found to be very high among children of preschool age examined during the summer and fall of 1979 in the National Nutrition Survey of the Yemen Arab Republic. Stunting is more prevalent than wasting, and both are more prevalent in the rural regions of Yemen than in urban Sana'a. Among the three rural regions - the Tihama, the Southern Highlands, and the Northern Highlands - prevalences of these two conditions vary considerably, and in opposite ways. Stunting is least prevalent in the Tihama and most prevalent in the Northern Highlands, while wasting is most prevalent in the Tihama and least prevalent in the Northern Highlands. In the Southern Highlands the prevalence of each condition is intermediate.

The prevalence of stunting tends to increase with increasing age, while the prevalence of wasting increases only slightly during the second year of life and then declines. Both conditions are at their smallest levels among 3 to 6 month old infants. Wasting is somewhat more common in boys than in girls, particularly during the second year of life.

Concurrent wasting and stunting, a severe form of undernutrition which is associated with measurably higher risks of ill health, is common in Yemen reaching prevalence levels of approximately 15 percent among 18 to 24 month old children in the combined rural regions. Illness, fever, and diarrhea are each more common among these wasted and stunted children.

Anemia is also extremely common in these survey children. Its prevalence shows a regional pattern similar to that of wasting. It is most common in the Tihama (82 percent) and least common in urban Sana'a (17 percent). Anemia is almost as common among the mothers of these children, and shows a similar regional pattern with a prevalence of 72 percent in the Tihama and only 5 percent in urban Sana'a.

The symptoms of illness and fever were no more common in stunted children than in normal children. The lower prevalence of stunting in urban Sana'a than in any of the three rural regions is an indication of the potential which exists, with changes in socioeconomic, cultural or dietary conditions, for long-term improvements in nutrition status.

Associations of stunting, wasting, and anemia with infant feeding practices and with various indicators of socioeconomic status are variable; further analyses of the survey data may elucidate these associations, but special studies will be necessary to determine appropriate intervention measures.

Breast-feeding is apparently an established practice. The duration of breast-feeding is longer for the less affluent and also among rural children than for urban children.

The dietary information of the National Nutrition Survey of the Yemen Arab Republic also illustrates that breast-feeding is still a preferred method of feeding the infant. The use of proprietary formulae, and

non-traditional weaning foods is limited primarily to urban Sana'a. Products similar to powdered milk are commonly used both in the rural regions and urban Sana'a and their use is an item of serious concern, since their dilution, as commonly carried out, will not provide adequate calories and nutrients for optimum infant growth and development. Additionally, the difficulty of maintaining the rubber nipples, bottles and their contents free of microbial contamination greatly increases the risk of diarrheal infections.

Although many foods are consumed both by young children and family members, such nutritious foods as legumes, fish, vegetables and fruits appear to be restricted in the diets of young children.

RECOMMENDATIONS

In accordance with observed prevalences and also with known health implications of the several kinds of malnutrition which have been documented by the National Nutrition Survey of the Yemen Arab Republic, the following priorities for action should be considered:

1. Among children of preschool age, interventions to decrease the prevalence of:
   a. concurrent wasting and stunting, particularly among 12 to 24 month old children, particularly in the Tihama,
   b. wasting alone, among the same subgroups, and
   c. anemia, particularly among children from 3 to 36 months of age, in all three rural regions.

2. Interventions to decrease the prevalence of anemia in rural regions among women of child bearing age.

Based on survey data possible avenues of intervention would be:

1. to persuade mothers to breast-feed their children at least for a year or more.

2. to teach practical and acceptable ways of utilizing and preparing indigenous weaning foods. These foods should include those generally available and utilized by the family.

What is primarily needed are new approaches to nutrition education and to food preparation which are appropriate for Yemen, and which have been field-tested at the community level for acceptability and effectiveness. It should not be presumed that such approaches can be introduced ready-made, on a large scale, or in a short time. Rather it seems certain that they must be pretested at the grass-roots level, preferably first in one Tihama village and in one rural highland village. In such field-testing, one or more respected community members, after having received an appropriate short course of special training, should serve as catalysts in their communities to share with local mothers and fathers in mutual teaching/learning processes to develop appropriate approaches to better nutrition.

To become aware of how effective such approaches may be, it is essential that each nutrition demonstration program have built into it the means to make estimates of births and deaths of children under 5, and take measurements of height, weight, and hemoglobin on these children, both in the pretest villages and, for comparison, in several neighboring villages, to evaluate whether or not improved levels of health, physical growth and hemoglobin do in fact occur, concomitant with the program.

Further guidance in these proposals will be sought in the Yemen Arab Republic in the immediate future, when this report and its implications are discussed with authorities responsible for improving nutritional health of the Yemeni people.

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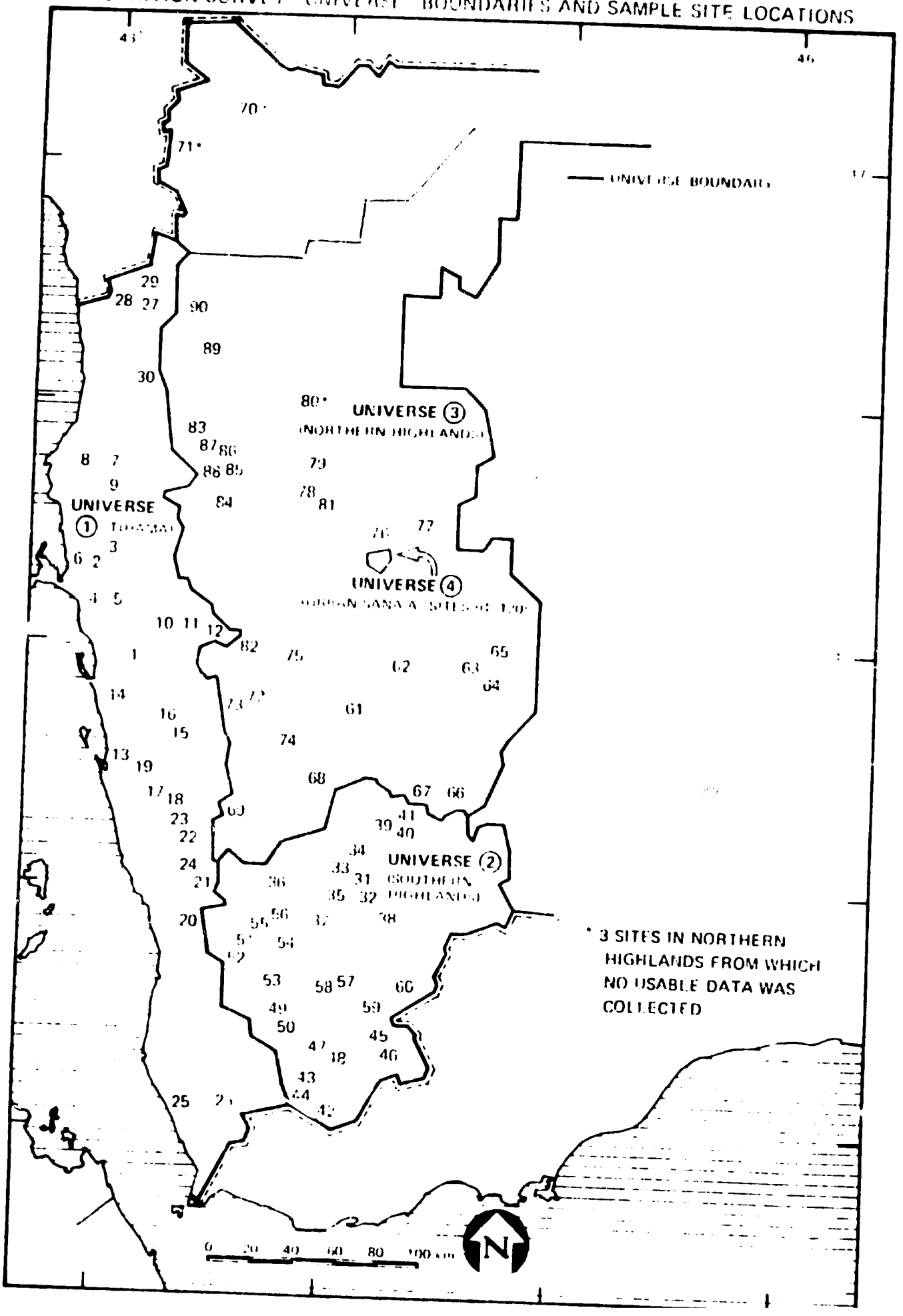
YEMEN ARAB REPUBLIC

NUTRITION SURVEY "UNIVERSE" BOUNDARIES AND SAMPLE SITE LOCATIONS



YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY
SURVEY SITES

TIHAMA (UNIVERSE 1)

SITE	QARYAH (VILLAGE)	NAHIYA (DISTRICT)	MOUHAFAZA (GOVERNORATE)
001	AL GHUMAINA	AL MARAWI'AH	AL HUDAYDAH
002	DAR AL WAJEIH	AZ ZAYDIYAH	AL HUDAYDAH
003	ANKAZA	AZ ZAYDIYAH	AL HUDAYDAH
004	AL MAJAAWIR	AZ ZAYDIYAH	AL HUDAYDAH
005	DEIR HUREISH	AD DAHI	AL HUDAYDAH
006	IBN ABBASS	AL MUNIRAH	AL HUDAYDAH
007	KHAMIS BANI AL HAIJ	AZ ZUHRA	AL HUDAYDAH
008	AL WATAWETA	AL LUHAYYAH	AL HUDAYDAH
009	BEHELAT AD DABWAN	AL LUHAYYAH	AL HUDAYDAH
010	AL OKAIDA'A	BAJIL	AL HUDAYDAH
011	MOHAMED ORR SHAIBA	BAJIL	AL HUDAYDAH
012	KHUR AL ASHRAF	BAJIL	AL HUDAYDAH
013	AL KARRN	AD DURAYHIMI	AL HUDAYDAH
014	AL MASHAKENA	AD DURAYHIMI	AL HUDAYDAH
015	DEIR KUMAT	AL MANSURIYAH	AL HUDAYDAH
016	AL MANSARA'A	AL MANSURIYAH	AL HUDAYDAH
017	AL HUSAINA AS SUFLA	BAYT AL FAQIH	AL HUDAYDAH
018	AD DAJARIA	BAYT AL FAQIH	AL HUDAYDAH
019	AD JA'AMENA	BAYT AL FAQIH	AL HUDAYDAH
020	HASSIS	HAYS	AL HUDAYDAH
021	MAHWA HAIDER	ZABID	AL HUDAYDAH
022	AL JURAIN	ZABID	AL HUDAYDAH
023	ASHUBITA	ZABID	AL HUDAYDAH
024	MAHAL ASH SHEIKH	ZABID	AL HUDAYDAH
025	AL MANDAB	MAWZA	TA'IZZ
026	AL MAWSANA	MAWZA	TA'IZZ
027	AL OSAILA	HARAD	HAJJAH
028	ASH SHARIEFIA	HARAD	HAJJAH
029	JERH YAHIA ZAKARIA	HARAD	HAJJAH
030	AL MAHATHERA	ABS	HAJJAH

YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY
SURVEY SITES

SOUTHERN HIGHLANDS (UNIVERSE 2)

SITE	QARYAH (VILLAGE)	NAHIYA (DISTRICT)	MOUFAFAZA (GOVERNORATE)
031	AL KHARBA	IBB	IBB
032	AR RUBAT	JIBLAH	IBB
033	AL HAJFAH	HUBAYSH	IBB
034	AL GASHA'EI	AL UDAYN	IBB
035	AL JA'ARRIE	AL UDAYN	IBB
036	AL HABEIL	AL ZAR	IBB
037	AL HAMADI	MUDHAYKHIRAH	IBB
038	AL HAKLEIN	AS SAYYANI	IBB
039	REHAB	AL FAR'	IBB
040	ALMARAHEB	YARIM	IBB
041	AL QBR	YARIM	IBB
042	AL BUKAIRA'A	TURBAT ASH SHAMA'ITAYN	TA'IZZ
043	JANADDUBBA'A	TURBAT ASH SHAMA'ITAYN	TA'IZZ
044	AL BATENA'A	TURBAT ASH SHAMA'ITAYN	TA'IZZ
045	AL ADMORE	AS SALU'	TA'IZZ
046	AL MEEZAJ	QABAYTA	TA'IZZ
047	AKHMORE KHARIJ	TURBAT AL MAWASIT	TA'IZZ
048	BUKIAN	TURBAT AL MAWASIT	TA'IZZ
049	WADI SUKAIB	JABAL HABASHI	TA'IZZ
050	YUFRUS	JABAL HABASHI	TA'IZZ
051	AL JUF	MAQBANAH	TA'IZZ
052	DAMEIN	MAQBANAH	TA'IZZ
053	AL HAIJAH	MAQBANAH	TA'IZZ
054	AL KADIED	SHARAB	TA'IZZ
055	AL A'HAD	SHARAB	TA'IZZ
056	AD'DUMAINA	SHARAB	TA'IZZ
057	HASANAT	SABIR AND AL MAWADIM	TA'IZZ
058	AL WADI	MISHRA'AH AND HADNAN	TA'IZZ
059	JABAL HUMEID	DIMNAT AL KHADIR	TA'IZZ
060	DABA'A	MAWIYAH	TA'IZZ

YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY
SURVEY SITES

NORTHERN HIGHLANDS (UNIVERSE 3)

SITE	QARYAH (VILLAGE)	NAHIYA (DISTRICT)	MOUHAFAZA (GOVERNORATE)
061	THAMA'AH	DAWRAN ANIS	DHAMAR
062	THAF	MABA'R	DHAMAR
063	DAHKA	AL HADA'	DHAMAR
064	BANIOMAR	AL HADA'	DHAMAR
065	BANI MAHDI	AL HADA'	DHAMAR
066	HUNOD	DHAMAR	DHAMAR
067	ADDUR (AN'NAHLA)	DHAMAR	DHAMAR
068	AL BARAH	UTHMAH	DHAMAR
069	ASH'SHAWAR	WASAB 'S SAFIL	DHAMAR
070	THAKA	MAJZ	SA'DAH*
071	AR'RADHA WATH'THAMRA	GHIMAR	SA'DAH**
072	AL MUSSIE	AL JABIN	SANA'A
073	ASH SHA'AF	AL JABIN	SANA'A
074	KHANA'A	AL JABIN	SANA'A
075	AL JARB	AL HAYMAT AL KHARIJIHAH	SANA'A
076	JADER AL DIA	BANI AL HARITH	SANA'A
077	OFRAN	BANI HUSAYSH	SANA'A
078	ASH SHEIM	THULA	SANA'A
079	SUBA'AIN	JABAL IYAL YAZID	SANA'A
080	BANI ABD	JABAL IYAL YAZID	SANA'A
081	AS'SARHA	SHIBAM	AL MAHWIT
082	MAKLAH	AL HUJJAYLAH	AL HUDAYDAH
083	AL MEDAB	ASH SHAHIL	HAJJAH
084	ABBS	BANI AL AWWAM	HAJJAH
085	ARRATA'A	HAJJAH	HAJJAH
086	KUDAM	HAJJAH	HAJJAH
087	AL KARAHEB	MABYAN	HAJJAH
088	BEIT HAMAD	NAJRAH	HAJJAH
089	BANI MALEK	KUSHAR	HAJJAH
090	ADDAHRA	WASSHAH	HAJJAH

*Northern Highlands was redefined to exclude Sa'dah.
**No usable data could be collected at this survey site.

YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY
SURVEY SITES

URBAN SANA'A (UNIVERSE 4)

SITE	STREET	INITIAL HOUSEHOLD	GOVERNORATE
091	SHARE'E ADDFA'A	HASHEM MHD. AL MOU'AIED	SANA'A
092	CHOREAT ASSEIN	AHD. ALY AL AKWA'A	SANA'A
093	HARAT ALMAHAFEDA	HAMOD MOSHKIL AL KURSUMI	SANA'A
094	KA'A SANA'A	AL HA'AJ MHD. ARREIDI	SANA'A
095	ASSAFIA	YAHIA YAHIA JUMA'AN	SANA'A
096	HARAT ALLAQIA	HAMAD AL KHUFASHI	SANA'A
097	SHARE'E SABIL AL WAGAD	ALY ABDURRAHMAN MUTAHAR	SANA'A
098	KA'A AL OLUFI	ABDULLAH ALY AL JARMEL	SANA'A
099	HARAT AL MANSURA	SALEH YAHIA ARRUDI	SANA'A
100	HARAT AL BALAKA	MAS'OD AHD. AL BAKAI	SANA'A
101	SHARE'E ATTAWFIQ	ABDULLAH MHD. SA'AD	SANA'A
102	HARAT MUSEIK	MARIAM ALY AL OMAISI	SANA'A
103	HARAT MUSEIF	ABDULLAH MHD. NASSER	SANA'A
104	HARAT HABRAH	MHD. SALEH AL JAIEFI	SANA'A
105	SHARE'E AL BAWSIA	AL HA'AJ ABD. AL HAMMAMI	SANA'A
106	ALHEI AL FDA'FI	MHD. SAEID FUAD	SANA'A
107	HARAT ASSIAH	RAJEH HUSSEIN JAR ALLAH	SANA'A
108	HARAT AL ABEIDI	ABU BAKR ALY S	SANA'A
109	SHARE'E AL JAMEA'A	MHD. HASSAN AL BAIADI	SANA'A
110	HARAT AL BASHA	HADI GHANEM AL HASHEDI	SANA'A
111	SHARE'E AL JALA	AHD. MHD. ASSUKHI	SANA'A
112	DHAR HEMIAR MUSAIK	REZK HUSSEIN AL OMMARI	SANA'A
113	AL JAMEA AL KABEIR	HUSSEIN KASSIM AL AMMARI	SANA'A
114	HARAT MAHMOUD	MHD. HUSSEIN MUBARAK	SANA'A
115	HARAT AZZUMOR	ALY MHD. AL AJAMI	SANA'A
116	HARAT BAB AL HURRIYAH	HUSSEIN AHD. SUWEID	SANA'A
117	BEIR KHAIRAN	MUHSSEN YAHIA MADGA	SANA'A
118	SHARE'E AL ABHAR	HUSSEIN MHD. ADDAILAMI	SANA'A
119	TARIEQ NUQUM	ALY AHD. GHAZZI	SANA'A
120	HARAT ANNORE	MHD. ABDUL RAHMAN	SANA'A

Appendix IV - Sample Size

Presurvey Determination of Survey Sample Size and Precision of Survey Data

Separate samples were drawn for each universe to allow comparison of these areas on various nutrition parameters. Thirty sample sites or clusters in each sample area allowed the use of normal parametric statistical procedures in the estimation of population characteristics* of a universe and in testing for a significant statistical difference among universes. For survey purposes Yemen was divided into four universes. With 30 sample sites in each universe, the total number of sample sites for the entire country was 120. As noted in the text the Northern Highlands universe was redefined to exclude Sa'dah resulting in only 28 sample sites.

To determine the appropriate survey sample size for a geographic area the applicability of binomial theory was assumed. Using binomial theory modified for cluster sampling there were four variables affecting sample size, ('n').

*Provided the characteristic is not rare (<5% prevalence).

Z = normal deviate for confidence level desired (1.96 for 95% confidence).

p = proportion of population having the attribute measured.

D = deviation from 'p' due to sampling with confidence level chosen; the confidence limits for p would be p $\pm$ D.

K = adjustment for "clustering effect."

The formula for 'n' is:

$$n = \frac{K\ Z^2}{D^2\ (p)\ (1-p)}$$

Past experience with NCHS/CDC percent of reference weight for height has shown that K = 2 should provide at least the desired precision for most attributes. The Z score is generally chosen for 95% confidence (Z = 1.96).

While the value of D can be predetermined, it depends on the value of 'p' and may or may not be acceptable; for example, 50% $\pm$ 5% might be considered acceptable but 10% $\pm$ 5% might not.

The value of 'p' yielding the largest 'n' is 0.5 (50%); therefore, if a number of different proportions are to be measured for the universe, it is safest to assume p = 0.5. After fixing K, Z, and p, n and D were the only values not determined.

By determining maximum deviation tolerable (D), 'n' for any sample area was solved for as follows:

$K = 2$ (cluster effect)

$Z = 1.96$ (95% confidence)

$p = 0.5$ (50%)

$D = 0.46$ (4.6%)

$$n = \frac{2\ (1.96)^2}{(.046)^2\ (.5)\ (.5)}$$

$n = 900$

A universe sample sample of 900 children with proportions having a characteristic varying as follows would have the following approximate precisions:

% Having Characteristics (p)	95% Confidence Limits (d)	Difference Required for Significance with 95% Confidence Level (p_1-p_2)
50.0%	±4.6%	6.5%
20.0%	±3.8%	5.4%
10.0%	±2.8%	3.9%
5.0%	±2.0%	2.8%

If two universes have a statistically significant difference with respect to a given characteristic, then they must differ on that characteristic at least to the extent shown in the last column (p_1-p_2).

In general, predetermination of the sample size does not predetermine the precision of survey estimates. Some parameters had greater precision than predicted and others had less. Computation of precision estimates

for every tabulation provided in the report and appendices would have required substantial computer time and was not done. Statistical precision figures are presented for basic survey parameters for the four universes (Tables 1-4) and the combined rural universes (Table 5). Precision statistics are not presented for hemoglobin results due to field problems in data collection.

The statistics presented are the mean, standard error of the mean, 95% confidence limits of the mean, and the design effect. The true mean can be assumed to be within the range of the mean plus or minus the 95% confidence limit, with 95% assurance. All statistics are based on the distribution of cluster (village) means and are on a survey child basis. The design effect is the ratio of the standard error based on individual children and the cluster standard error. The design effect squared is equivalent to 'K' (Cluster effect) mentioned in the formula at the beginning of this appendix. Prior to the survey, a value of two was estimated for 'K' at the SHS level. This is equivalent to a design effect of 1.414.

TABLE 1. PRECISION SUMMARY FOR THE TIHAMA CHILDREN 3-59 MONTHS OF AGE: YEMEN 1979

VARIABLE	MEAN	STANDARD ERROR	95 PERCENT CONFIDENCE	DESIGN EFFECT
% MALE	55.732	2.105	4.126	1.211
AGE IN MONTHS	26.447	0.523	1.026	0.979
WEIGHT FOR HEIGHT % OF MEDIAN	87.479	0.347	0.680	1.192
HEIGHT FOR AGE % OF MEDIAN	92.204	0.247	0.483	1.446
WEIGHT FOR AGE % OF MEDIAN	75.224	0.443	0.867	1.255
WEIGHT FOR HEIGHT S. D. FROM MEDIAN	-1.381	0.038	0.074	1.250
HEIGHT FOR AGE S. D. FROM MEDIAN	-2.006	0.064	0.126	1.473
WEIGHT FOR AGE S. D. FROM MEDIAN	-2.319	0.043	0.084	1.273
WEIGHT FOR HEIGHT PERCENTILE	14.377	0.725	1.420	1.238
HEIGHT FOR AGE PERCENTILE	10.525	0.821	1.608	1.324
WEIGHT FOR AGE PERCENTILE	4.857	0.392	0.769	1.123
% WEIGHT FOR HEIGHT < 80% OF MEDIAN	15.879	1.317	2.581	1.034
% HEIGHT FOR AGE < 90% OF MEDIAN	31.885	2.130	4.176	1.304
% WEIGHT FOR AGE < 75% OF MEDIAN	51.171	2.122	4.160	1.215
% WEIGHT FOR HEIGHT > 2 S. D. BELOW MEAN	23.853	1.720	3.372	1.159
% HEIGHT FOR AGE > 2 S. D. BELOW MEAN	51.833	2.663	5.219	1.525
% WEIGHT FOR AGE > 2 S. D. BELOW MEAN	64.642	2.255	4.420	1.352
% WEIGHT FOR HEIGHT > 1.5 S. D. BELOW MEAN	45.558	1.973	3.867	1.134
% HEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	34.273	1.882	3.688	1.132
% WEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	42.617	1.974	3.870	1.140
BIRTH ORDER	4.467	0.149	0.293	1.476
HOUSEHOLD SIZE	7.049	0.212	0.416	2.094

ALL STATISTICS ARE BASED ON MEANS FROM 30 VILLAGES USING NCHS/CDC REFERENCE WHERE APPLICABLE

STANDARD ERROR DIVIDED BY DESIGN EFFECT IS THE STANDARD ERROR ASSUMING RANDOM CHILD SELECTION

TABLE 2. PRECISION SUMMARY FOR THE SOUTHERN HIGHLANDS CHILDREN 3-59 MONTHS OF AGE: YEMEN 1979

VARIABLE	MEAN	STANDARD ERROR	95 PERCENT CONFIDENCE	DESIGN EFFECT
% MALE	55.256	1.893	3.710	1.185
AGE IN MONTHS	26.580	0.486	0.952	0.945
WEIGHT FOR HEIGHT % OF MEDIAN	90.769	0.473	0.928	1.954
HEIGHT FOR AGE % OF MEDIAN	90.979	0.286	0.561	1.887
WEIGHT FOR AGE % OF MEDIAN	76.336	0.528	1.035	1.702
WEIGHT FOR HEIGHT S. D. FROM MEDIAN	-1.024	0.052	0.101	1.999
HEIGHT FOR AGE S. D. FROM MEDIAN	-2.313	0.071	0.140	1.858
WEIGHT FOR AGE S. D. FROM MEDIAN	-2.199	0.048	0.093	1.636
WEIGHT FOR HEIGHT PERCENTILE	21.030	1.256	2.462	1.964
HEIGHT FOR AGE PERCENTILE	6.691	0.571	1.119	1.308
WEIGHT FOR AGE PERCENTILE	5.258	0.449	0.880	1.343
% WEIGHT FOR HEIGHT < 80% OF MEDIAN	5.443	0.748	1.465	1.024
% HEIGHT FOR AGE < 90% OF MEDIAN	39.369	2.773	5.435	1.767
% WEIGHT FOR AGE < 75% OF MEDIAN	45.458	2.621	5.138	1.639
% WEIGHT FOR HEIGHT > 2 S. D. BELOW MEAN	9.161	1.284	2.516	1.384
% HEIGHT FOR AGE > 2 S. D. BELOW MEAN	60.636	2.221	4.353	1.415
% WEIGHT FOR AGE > 2 S. D. BELOW MEAN	59.623	2.508	4.915	1.590
% WEIGHT FOR HEIGHT > 1.5 S. D. BELOW MEAN	28.702	2.414	4.731	1.664
% HEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	41.056	2.776	5.441	1.756
% WEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	37.363	2.324	4.555	1.496
BIRTH ORDER	4.031	0.151	0.297	1.268
HOUSEHOLD SIZE	7.276	0.302	0.591	2.827

ALL STATISTICS ARE BASED ON MEANS FROM 30 VILLAGES USING NCHS/CDC REFERENCE WHERE APPLICABLE

STANDARD ERROR DIVIDED BY DESIGN EFFECT IS THE STANDARD ERROR ASSUMING RANDOM CHILD SELECTION

TABLE 3. PRECISION SUMMARY FOR THE NORTHERN HIGHLANDS CHILDREN 3-59 MONTHS OF AGE: YEMEN 1979

VARIABLE	MEAN	STANDARD ERROR	95 PERCENT CONFIDENCE	DESIGN EFFECT
% MALE	55.142	2.903	5.689	1.558
AGE IN MONTHS	26.041	0.510	1.000	0.927
WEIGHT FOR HEIGHT % OF MEDIAN	92.669	0.601	1.179	1.943
HEIGHT FOR AGE % OF MEDIAN	90.118	0.310	0.608	1.739
WEIGHT FOR AGE % OF MEDIAN	76.518	0.574	1.124	1.617
WEIGHT FOR HEIGHT S. D. FROM MEDIAN	-0.814	0.063	0.124	1.954
HEIGHT FOR AGE S. D. FROM MEDIAN	-2.540	0.079	0.154	1.734
WEIGHT FOR AGE S. D. FROM MEDIAN	-2.189	0.054	0.106	1.611
WEIGHT FOR HEIGHT PERCENTILE	26.441	1.710	3.351	2.030
HEIGHT FOR AGE PERCENTILE	5.519	0.710	1.392	1.383
WEIGHT FOR AGE PERCENTILE	5.242	0.538	1.054	1.282
% WEIGHT FOR HEIGHT < 80% OF MEDIAN	3.868	0.815	1.598	1.118
% HEIGHT FOR AGE < 90% OF MEDIAN	50.585	2.911	5.705	1.552
% WEIGHT FOR AGE < 75% OF MEDIAN	47.146	2.387	4.678	1.275
% WEIGHT FOR HEIGHT > 2 S. D. BELOW MEAN	7.047	1.210	2.372	1.240
% HEIGHT FOR AGE > 2 S. D. BELOW MEAN	70.607	2.530	4.959	1.475
% WEIGHT FOR AGE > 2 S. D. BELOW MEAN	61.548	2.764	5.417	1.513
% WEIGHT FOR HEIGHT > 1.5 S. D. BELOW MEAN	19.183	2.551	5.000	1.716
% HEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	53.407	2.815	5.517	1.504
% WEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	35.756	2.649	5.193	1.472
BIRTH ORDER	4.049	0.157	0.307	1.510
HOUSEHOLD SIZE	8.150	0.387	0.758	2.047

ALL STATISTICS ARE BASED ON MEANS FROM 27 VILLAGES USING NCHS/CDC REFERENCE WHERE APPLICABLE

STANDARD ERROR DIVIDED BY DESIGN EFFECT IS THE STANDARD ERROR ASSUMING RANDOM CHILD SELECTION

TABLE 4. PRECISION SUMMARY FOR TOTAL RURAL CHILDREN 3-59 MONTHS OF AGE: YEMEN 1979

VARIABLE	MEAN	STANDARD ERROR	95 PERCENT CONFIDENCE	DESIGN EFFECT
% MALE	55.297	1.080	2.117	1.031
AGE IN MONTHS	26.364	0.224	0.440	0.697
WEIGHT FOR HEIGHT % OF MEDIAN	90.886	0.275	0.539	1.634
HEIGHT FOR AGE % OF MEDIAN	90.880	0.149	0.292	1.488
WEIGHT FOR AGE % OF MEDIAN	76.210	0.243	0.477	1.203
WEIGHT FOR HEIGHT S. D. FROM MEDIAN	-1.010	0.030	0.058	1.672
HEIGHT FOR AGE S. D. FROM MEDIAN	-2.341	0.038	0.074	1.483
WEIGHT FOR AGE S. D. FROM MEDIAN	-2.216	0.023	0.044	1.183
WEIGHT FOR HEIGHT PERCENTILE	21.828	0.737	1.444	1.665
HEIGHT FOR AGE PERCENTILE	6.929	0.334	0.654	1.124
WEIGHT FOR AGE PERCENTILE	5.184	0.218	0.427	0.960
% WEIGHT FOR HEIGHT < 80% OF MEDIAN	6.669	0.490	0.960	1.016
% HEIGHT FOR AGE < 90% OF MEDIAN	42.104	1.431	2.805	1.378
% WEIGHT FOR AGE < 75% OF MEDIAN	47.043	1.121	2.196	1.066
% WEIGHT FOR HEIGHT > 2 S. D. BELOW MEAN	10.924	0.735	1.440	1.199
% HEIGHT FOR AGE > 2 S. D. BELOW MEAN	62.698	1.258	2.466	1.259
% WEIGHT FOR AGE > 2 S. D. BELOW MEAN	61.174	1.173	2.299	1.141
% WEIGHT FOR HEIGHT > 1.5 S. D. BELOW MEAN	28.183	1.320	2.586	1.457
% HEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	44.318	1.422	2.787	1.365
% WEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	37.688	1.111	2.177	1.091
BIRTH ORDER	4.112	0.069	0.136	1.032
HOUSEHOLD SIZE	7.550	0.153	0.299	1.706

ALL STATISTICS ARE BASED ON MEANS FROM 87 VILLAGES USING NCHS/CDC REFERENCE WHERE APPLICABLE

STANDARD ERROR DIVIDED BY DESIGN EFFECT IS THE STANDARD ERROR ASSUMING RANDOM CHILD SELECTION

TABLE 5. PRECISION SUMMARY FOR URBAN SANA'A CHILDREN 3-59 MONTHS OF AGE: YEMEN 1979

VARIABLE	MEAN	STANDARD ERROR	95 PERCENT CONFIDENCE	DESIGN EFFECT
% MALE	47.911	2.062	4.041	1.125
AGE IN MONTHS	27.069	0.586	1.148	1.049
WEIGHT FOR HEIGHT % OF MEDIAN	95.553	0.433	0.848	1.443
HEIGHT FOR AGE % OF MEDIAN	92.281	0.222	0.435	1.211
WEIGHT FOR AGE % OF MEDIAN	82.287	0.417	0.817	1.135
WEIGHT FOR HEIGHT S. D. FROM MEDIAN	-0.514	0.046	0.089	1.491
HEIGHT FOR AGE S. D. FROM MEDIAN	-1.978	0.057	0.111	1.211
WEIGHT FOR AGE S. D. FROM MEDIAN	-1.653	0.040	0.079	1.186
WEIGHT FOR HEIGHT PERCENTILE	34.214	1.299	2.546	1.510
HEIGHT FOR AGE PERCENTILE	10.631	0.798	1.564	1.193
WEIGHT FOR AGE PERCENTILE	11.216	0.707	1.386	1.215
% WEIGHT FOR HEIGHT < 80% OF MEDIAN	2.117	0.528	1.036	0.993
% HEIGHT FOR AGE < 90% OF MEDIAN	32.981	1.794	3.516	1.037
% WEIGHT FOR AGE < 75% OF MEDIAN	22.769	1.535	3.009	0.995
% WEIGHT FOR HEIGHT > 2 S. D. BELOW MEAN	3.361	0.675	1.324	1.021
% HEIGHT FOR AGE > 2 S. D. BELOW MEAN	48.370	2.379	4.664	1.297
% WEIGHT FOR AGE > 2 S. D. BELOW MEAN	35.461	2.065	4.048	1.175
% WEIGHT FOR HEIGHT > 1.5 S. D. BELOW MEAN	11.205	1.254	2.457	1.085
% HEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	34.170	1.916	3.756	1.099
% WEIGHT FOR AGE > 2.5 S. D. BELOW MEAN	17.481	1.428	2.798	1.019
BIRTH ORDER	4.627	0.120	0.235	0.784
HOUSEHOLD SIZE	8.686	0.333	0.654	2.328

ALL STATISTICS ARE BASED ON MEANS FROM 30 VILLAGES USING NCHS/CDC REFERENCE WHERE APPLICABLE

STANDARD ERROR DIVIDED BY DESIGN EFFECT IS THE STANDARD ERROR ASSUMING RANDOM CHILD SELECTION

FORM 1

1977 YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY 1399

DATE OF VISIT — YEAR ☐☐ MONTH ☐☐ (1-6) DAY ☐☐

HOUSEHOLD — INFORMANT ☐ (9) SIZE ☐☐ (10-11) ID ☐☐ (12-13) TEAM ☐ (14) GOVERNATE ☐☐ (15-16) UNIVERSE ☐ (17)

SAMPLE SITE ☐☐ (18-20)

REMITTANCE INFORMATION

(21) ☐ 9 UNK. ☐ 2 NO ☐ 1 YES IS A MEMBER OF THIS HOUSEHOLD PRESENTLY WORKING IN A NEARBY COUNTRY?

(22) ☐ IF YES, IN WHAT COUNTRY IS HE WORKING?

(23) ☐ WHAT IS HIS OCCUPATION THERE?

(24-25) ☐☐ FOR WHAT IS HIS REMITTANCE, FOR THE MOST PART, SPENT?

CHILD DEMOGRAPHIC DATA

(26) ☐ 9 UNK. ☐ 2 NO ☐ 1 YES IS A MEMBER OF THIS HOUSEHOLD A CHILD BETWEEN 3 & 60 MONTHS OF AGE?

YEAR ☐☐ MONTH ☐☐ DAY ☐☐ (27-32) IF YES, WHAT IS THE CHILD'S DATE OF BIRTH?

CHILD'S ID ☐☐ (33-34)

(35) ☐ 2 ☐ 1 WHAT IS THE CHILD'S SEX? (36) ☐ 3 OTHER ☐ 2 HISTORICAL ☐ 1 VERIFIED CALENDAR RECORD WHAT IS THE SOURCE OF THE BIRTH DATA?

(37) ☐ WHAT IS THE CHILD'S MOTHER'S ORDER IN THE HOUSEHOLD? (38-39) ☐☐ WHAT IS THE CHILD'S BIRTH ORDER?

MOTHER ONLY

(43-44) ☐☐ HOW MANY YEARS HAS IT BEEN SINCE YOU WERE FIRST MARRIED?

MONTHS ☐☐☐ (40-42) IF THIS IS YOUR FIRST-BORN, HOW LONG AFTER YOUR FIRST MARRIAGE WAS THIS CHILD BORN?

☐☐☐ (45-47) IF THIS IS YOUR 2ND OR LATER-BORN, HOW LONG AFTER YOUR NEXT-OLDEST CHILD WAS THIS CHILD BORN?

☐☐ (49-50) HOW MANY OF YOUR CHILDREN ARE LIVING TODAY? ☐☐ (51-52) HOW MANY OF THE CHILDREN TO WHOM YOU HAVE GIVEN BIRTH WERE BORN ALIVE?

(53) 2 ☐ NO 1 ☐ YES HAVE YOU GIVEN BIRTH TO A CHILD IN THE PAST 3 MONTHS?

(54) ☐ 2 NO ☐ 1 YES ARE YOU BREAST-FEEDING ANY CHILD NOW? (55) 9 ☐ UNK 2 ☐ NO 1 ☐ YES ARE YOU PREGNANT NOW?

(48) 1 ☐ PRESENT 2 ☐ ABSENT 3 ☐ OTHER

BREAST-FEEDING (CAN BE ASKED OF ANY RESPONSIBLE INFORMANT)

(56) 2 ☐ NO 1 ☐ YES IS THIS CHILD BEING BREAST-FED, TO ANY DEGREE, TODAY?

(57-58) ☐☐ IF NO, AT WHAT AGE WAS THIS CHILD LAST BREAST-FED?

(61-62) ☐☐ AT WHAT AGE WAS THIS CHILD: FIRST GIVEN OTHER FOODS? ☐☐ (59-60) FIRST GIVEN MILK IN A BOTTLE?

CLINICAL SYMPTOMS

(63) 9 ☐ UNK 2 ☐ NO 1 ☐ YES BEEN SICK, THAT IS, UNABLE TO EAT, PLAY, ETC.?

(64) 9 ☐ UNK 2 ☐ NO 1 ☐ YES HAD FEVER FOR MORE THAN 2 CONSECUTIVE DAYS?

(65) 9 ☐ UNK 2 ☐ NO 1 ☐ YES HAD DIARRHEA, THAT IS, 4 OR MORE WATERY STOOLS FOR MORE THAN 2 DAYS?

FATHER DATA

(66) 9 ☐ UNK 2 ☐ NO 1 ☐ YES CAN YOU (CAN THE FATHER) READ OR WRITE?

(67) 5 ☐ UNIVERSITY 4 ☐ SECONDARY 3 ☐ PREPARATORY 2 ☐ PRIMARY 1 ☐ NONE IF YES, WHAT IS THE HIGHEST SCHOOL CERTIFICATE?

(68-69) ☐☐ WHAT IS THE FATHER'S FULL-TIME OCCUPATION?

(70) 1 ☐ PRESENT 2 ☐ ABSENT 3 ☐ OTHER

SOCIOECONOMIC INDICATORS

(71-73) ☐☐☐ MINUTES HOW LONG DOES IT TAKE TO REACH YOUR SOURCE OF WATER?

(74) 2 ☐ NO 1 ☐ YES DOES THIS HOUSE HAVE ELECTRICITY?

(75) 4 ☐ OTHER? 3 ☐ BOTTLE GAS? 2 ☐ KEROSENE? 1 ☐ OPEN FIRE? IN THIS HOUSEHOLD, DO YOU COOK WITH:

CLINICAL SIGNS

DOES THIS CHILD HAVE ANY OF THE FOLLOWING CLINICAL SIGNS:

(76) 2 ☐ NO 1 ☐ YES FRONTAL BOSSING? (77) 2 ☐ NO 1 ☐ YES OPEN ANTERIOR FONTANELLE? (78) 2 ☐ NO 1 ☐ YES ANGULAR STOMATITIS?

(79) 2 ☐ NO 1 ☐ YES THE LEGS? (80) 2 ☐ NO 1 ☐ YES THE WRISTS? (81) 2 ☐ NO 1 ☐ YES DEFORMITY OF: THE CHEST?

(82) 2 ☐ 1 ☐ BILATERAL PRE-TIBIAL EDEMA?

ANTHROPOMETRY

KILOGRAMS ☐☐☐ (83-85) WEIGHT CENTIMETERS ☐☐☐ (86-89) WEIGHT

LABORATORY

HEMOGLOBIN CONCENTRATION ☐☐ ☐ (90-92) (CHILD'S) ☐☐ ☐ (95-97) (MOTHER'S)

FILTER PAPER TAKEN? (93) 2 ☐ NO 1 ☐ YES

BLOOD DRAWN? (94) 2 ☐ NO 1 ☐ YES (CHILD'S) (98) 2 ☐ NO 1 ☐ YES (MOTHER'S)

١٢٩٩ المسح العراقي للجمهورية العربية السورية ١٩٧٩

١

معلومات عن الطفل	[illegible]
معلومات عن الأهل	[illegible]
بيانات عن الطفل	[illegible]
أسئلة للأم فقط (٥٨)	[illegible]
أسئلة للمبلغ بالمسكن	[illegible]
بيانات عن الأب (٥٩)	[illegible]
أحد الوالدين أو أي شخص آخر	[illegible]
الملاحظات الإكلينيكية	[illegible]
المقاييس	الطول [ ] [ ] [ ] سم (٨٦-٨٩) الوزن [ ] [ ] . [ ] كغم (٨٩-٩٢)
الصحائف	[illegible]

FORM 2

1979 YEMEN ARAB REPUBLIC NATIONAL NUTRITION SURVEY, 1979

DIETARY QUESTIONNAIRE

DATE OF EXAMINATION	INFORMANT	HOUSEHOLD SIZE	HOUSEHOLD ID	TEAM	CHECK DATE	UNIVERSE	SAMPLE SITE	CHILD'S ID
1-6	9	10-11	12-15	16	5-6	17	18-20	

CHILD WHAT DID YOUR CHILD EAT YESTERDAY?

				MANUFACTURED FOOD				OTHER BEVERAGES			MILK & MILK PRODUCTS
23				CHEESE, BISCUITS	57			TEA, SUGAR WATER	88		BREAST MILK
24				PASTA, FARINA	58			CANADA, COLAS	89		COW, GOAT, SHEEP, CAMEL
25				FERNULA, SALA, MARIANSA	59			FRUIT JUICE, JUICE DRINKS	90		YOGURT, SOUR MILK, CHEESE
26				NIDO, NINA, FAMILY MILK	60			BOILED COFFEE HUSKS	91		EVAPORATED MILK
27				OTHER	61			OTHER	92		OTHER
				IMPORTANT STAPLES				ROOT CROPS			WEANING FOODS
28				SORGHUM, BARLEY	62			POTATOES	93		TRADITIONAL
29				MILLET, MAIZE	63			OTHER	94		NON-TRADITIONAL
30				WHOLE WHEAT				LEGUME DISHES			LEGUMES & NUTS
31				RICE, DEHULLED FLOUR	64			LEGUME PORRIDGE, BREADS	95		BROAD BEANS, LENTILS
32				OTHER	65			HELBAH	96		PUMPKIN SEEDS, ALMONDS, GROUND NUTS
					66			OTHER	97		OTHER
				MEATS				POULTRY	98		
33				GOAT, BEEF, MUTTON	67			CHICKEN, PIGEON	99		MEAT BACON
34				RABBIT, GUINEA PIG	68			OTHER			OTHER VEGETABLES
35				OTHER	69				100		OKRA, EGGPLANT, CUCUMBER
				VEGETABLES					101		OTHER
36				ONIONS, GARLIC				FRUITS			OTHER FRUITS
37				KORRAT, BAYA, TOMATO, RADISH	70			MELONS, SHAMEN	102		BANANAS, DATES, APPLES, MANGO, PAPAYA
38				PEPPERS - RED & GREEN	71			RAISINS, DATES, FIGS	103		OTHER
39				PEPPERS, DRIED	72			APRICOTS, MANGOS, PAPAYAS			
				FISH	73			ITRON, LIME, ORANGE, LIME			OTHER FOODS
40				FRESH OR DRIED: TUNA, SARDINES, WASIF				EGGS	104		CANDIES, HONEY, SWEETS
41				CANNED: SARDINES, TUNA	74						

42 WAS G L OR SUMN (GHEE) USED IN COOKING THIS FOOD?

43-44 HOW MANY TIMES DID THIS CHILD EAT YESTERDAY?

FAMILY WHAT DID THE OTHER FAMILY MEMBERS EAT YESTERDAY?

				FISH				LEGUMES & NUTS			MILK & MILK PRODUCTS
45				FRESH OR DRIED: TUNA, SARDINES, WASIF	75			BROAD BEANS, FUL	105		COW, GOAT, SHEEP, CAMEL
46				CANNED: SARDINES, TUNA	76			ALMONDS, GROUND NUTS, PUMPKIN SEEDS	106		YOGURT, SOUR MILK, CHEESE
				EGGS	77			OTHER	107		EVAPORATED MILK
47					78			LEGUME DISHES: HELBAH, CAFO'A	108		OTHER
				IMPORTANT STAPLES				MEATS			OTHER BEVERAGES
48				SORGHUM, BARLEY	79			GOAT, BEEF	109		TEA, COFFEE, BUNN
49				MILLET, MAIZE	80			RABBIT, GUINEA PIG			POULTRY
50				WHOLE WHEAT	81			OTHER	110		CHICKEN, PIGEON
51				RICE, DEHULLED FLOUR				VEGETABLES	111		OTHER
52				OTHER	82			ONIONS, GARLIC			ROOT CROPS
				OTHER VEGETABLES	83			KORRAT, BAYA, TOMATO, RADISH	112		POTATOES
53				OKRA, EGGPLANT	84			PEPPERS - RED & GREEN	113		OTHER
54				OTHER	85			PEPPERS DRIED			FRUITS
				WHEN EAT YESTERDAY?				OTHER FRUITS	114		MELONS, SHAMEN
55				YOU YOURSELF	86			BANANAS, APPLES	115		RAISINS, DATES, FIGS
56				ANYONE IN HOUSE	87			OTHER	116		APRICOTS, MANGOS, PAPAYAS
									117		OTHER, GUINCE, LEMON, ORANGE

FORM ٢

استمارة "٢"

"١٣٩٩" المسح الغذائي للجمهورية العربية اليمنية "١٩٧٩"

خاص بالطفل ... ما الذي أكله طفلك بالأمس ؟

الألبان ومنتجاتها

غير ذلك

بعض

هل استعمل الزيت أو السمن في طهي الطعام ؟

كم من المرات أكل هذا الطفل بالأمس ؟

خاص بالأسرة ... ماذا أكل باقي أفراد الأسرة بالأمس ؟

الألبان ومنتجاتها

بعض

Appendix VI - Data Presentation Using Percents of Median

This appendix presents prevalences of: (1) stunting (low height for age), (2) wasting (low weight for height), (3) combined stunting and wasting, and (4) low weight for age using percent of median cut-off levels rather than -2.0 SD unit cut-off levels as used in the main report. The following commonly-used percent of median levels have been used: 90 percent of median height for age, 80 percent of median weight for height, and 75 percent of median weight for age. These prevalences are weighted, based upon population proportions and sampling variations.

These tables will permit more meaningful comparison of the results of the Yemen survey with those of other surveys, most of which have used percent of median cut-offs at the levels given above.

The prevalences of undernutrition as determined by these percent of median cut-off levels are all considerably lower than those determined by the -2.0 SD unit cut-off level.

The final summary table (Appendix VI: Summary) presents comparable prevalences, by these two methods of determination, of low height for age, low weight for height, and low weight for age for the three rural regions, separately and combined, and for urban Sana'a. It is evident that, for the index of height for age, at the 90 percent level, SD unit cut-off values between -2.5 and -3.0 yield equivalent prevalence rates. For the indices of weight for height (80 percent) and weight for age (75 percent), the SD unit equivalent values are midway between -2.0 and -2.5.

Table 1. Percentage Distribution of Survey Children
by Height for Age Percents of Median
by Region: Yemen 1979

(NCHS/CDC Reference)

Height for Age % of Median	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Less than 80.0	0.8	0.8	1.3	1.3	1.0	1.0	1.1	1.1	0.6	0.6
80.0-84.9	5.8	6.6	9.0	10.3	12.3	13.3	9.6	10.7	4.7	5.3
85.0-89.9	25.3	31.9	29.1	39.4	37.3	50.6	31.4	42.1	27.7	33.0
90.0-94.9	39.5	71.4	42.6	82.0	34.8	85.4	39.3	81.4	39.7	72.7
95.0 and more	28.6	100.0	18.0	100.0	14.6	100.0	18.6	100.0	27.3	100.0
TOTAL[a]	100.0	(819)	100.0	(970)	100.0	(712)	100.0	(2501)	100.0	(744)

a/Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

Table 2. Percentage Distribution of Survey Children
by Weight for Height Percents of Median
by Region: Yemen 1979

(NCHS/CDC REFERENCE)

Weight for Height % of Median	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Less than 70.0	0.9	0.9	0.5	0.5	0.8	0.8	0.7	0.7	0.1	0.1
70.0- 79.9	15.0	15.9	4.9	5.4	3.0	3.9	6.0	6.7	2.0	2.1
80.0- 84.9	23.4	39.3	15.7	21.2	11.9	15.7	15.7	22.4	5.9	8.0
85.0-119.9	60.4	99.7	78.6	99.8	83.9	99.6	77.3	99.7	91.4	99.4
120.0 and more	0.3	100.0	0.2	100.0	0.4	100.0	0.3	100.0	0.6	100.0
Total[a]	100.0	(819)	100.0	(970)	100.0	(712)	100.0	(2501)	100.0	(744)

[a] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

Table 3. Percentage Distribution of Survey Children
by Weight for Age Percents of Median
by Region: Yemen 1979

(NCHS/CDC Reference)

Weight for Age % of Median	Region									
	Tihama		Southern Highlands		Northern Highlands		Combined Rural		Urban Sana'a	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Less than 60.0	6.2	6.2	4.1	4.0	2.8	2.8	4.0	4.0	1.0	1.0
60.0-69.9	23.3	29.5	20.5	24.5	20.7	23.5	21.1	25.1	9.4	10.4
70.0-74.9	21.6	51.2	20.9	45.5	23.6	47.1	22.0	47.0	12.4	22.8
75.0-89.9	41.5	92.6	47.1	92.5	45.8	92.9	45.6	92.7	55.5	78.3
90.0 and more	7.4	100.0	7.5	100.0	7.1	100.0	7.3	100.0	21.7	100.0
TOTAL[a]	100.0	(819)	100.0	(970)	100.0	(712)	100.0	(2501)	100.0	(744)

[a] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

Table 4. Percentage Distribution
of Survey Children by Waterlow Classes by Region: Yemen 1979

(NCHS/CDC Reference)

Region	Waterlow Class[a]				
	Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]
Tihama	9.2%	25.2%	6.7%	58.9%	100.0% (819)
Southern Highlands	2.8%	36.7%	2.7%	57.9%	100.0% (970)
Northern Highlands	2.3%	49.0%	1.5%	47.1%	100.0% (712)
Combined Rural	3.7%	39.1%	3.0%	54.2%	100.0% (2501)
Urban Sana'a	1.8%	32.7%	0.3%	65.2%	100.0% (744)

[a] Wasting only: Weight for Height < 80 percent of median and Height for Age ≥90 percent of median.
Stunting only: Height for Age < 90 percent of median and Weight for Height ≥80 percent of median.
Wasting and Stunting: Weight for Height <80 percent of median and Height for Age <90 percent of median.

[b] Percentages are weighted based on population proportions; actual number surveyed are given in parentheses.

Table 5. Percentage Distribution of Survey Children by Waterlow Classes by Age: Yemen 1979 (NCHS/CDC Reference)

COMBINED RURAL

Age in Months	Waterlow Class[a] Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]
3-5	4	14	1	81	100 (164)
6-11	6	22	2	70	100 (368)
12-17	5	28	3	64	100 (356)
18-23	3	47	5	45	100 (290)
24-35	4	41	3	52	100 (552)
36-47	2	52	3	44	100 (476)
48-59	3	56	3	38	100 (295)
Total	4	39	3	54	100 (2501)

URBAN SANA'A

Age in Months	Waterlow Class[a] Wasting Only	Stunting Only	Wasting and Stunting	Normal	Total[b]
3-5	5	19	-	77	100 (44)[c]
6-11	3	20	1	76	100 (97)
12-17	3	17	-	80	100 (111)
18-23	-	44	-	56	100 (63)
24-35	3	29	-	68	100 (193)
36-47	-	43	1	57	100 (130)
48-59	-	55	-	45	100 (106)
Total	2	33	-	65	100 (744)

[a] Wasting only: Weight for Height < 80 percent of median and Height for Age ≥90 percent of median.
Stunting only: Height for Age < 90 percent of median and Weight for Height ≥80 percent of median.
Wasting and Stunting: Weight for Height < 80 percent of median and Height for Age < 90 percent of median.

[b] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.

[c] N less than 50 is considered statistically unreliable.

Summary Table
Prevalence of Undernutrition in Survey Children
Standard Deviations Percents of Median: Yemen 1979
(NCHS/CDC Reference)

Region	Anthropometric Indices[a]								
	Height for Age			Weight for Height			Weight for Age		
	Standard Deviation		Percent of Median	Standard Deviation		Percent of Median	Standard Deviation		Percent of Median
	<-2.5	<-2.0	<90	<-2.5	<-2.0	<80	<-2.5	<-2.0	<75
Tihama	34.3%	51.8%	31.9%	8.3%	23.9%	15.9%	42.6%	64.6%	51.2%
Southern Highlands	41.1%	60.6%	39.4%	2.6%	9.2%	5.4%	37.4%	59.6%	45.5%
Northern Highlands	53.4%	70.6%	50.5%	2.3%	7.0%	3.9%	35.8%	61.6%	47.1%
Combined Rural	44.3%	62.7%	42.1%	3.5%	10.9%	6.7%	37.7%	61.2%	47.0%
Urban Sana'a	34.2%	48.4%	33.0%	0.8%	3.4%	2.1%	17.5%	35.5%	22.8%

[a]Percentages are weighted based on population proportions.

Appendix VII - Age Distribution of Survey Children
Percentage Distribution of Survey Children by Age, Sex and Region: Yemen 1979

Age in Months	Region: Tinama	Southern Highlands	Northern Highlands	Combined Rural	Urban Sana'a
3-5					
Male	4.7%	8.0%	5.7%	6.6%	4.8%
Female	8.0%	5.7%	7.2%	6.6%	6.9%
Total	6.2%	6.9%	6.4%	6.6%	5.9%
6-11					
Male	17.4%	13.1%	13.3%	14.1%	15.2%
Female	13.7%	16.5%	12.9%	14.7%	11.1%
Total	15.8%	14.6%	13.4%	14.4%	13.1%
12-17					
Male	13.4%	15.0%	14.6%	14.6%	13.5%
Female	12.4%	13.9%	17.0%	14.7%	16.2%
Total	12.9%	14.5%	15.7%	14.6%	14.9%
18-23					
Male	8.4%	12.8%	11.8%	11.7%	8.1%
Female	10.7%	13.5%	11.8%	12.4%	9.0%
Total	9.4%	13.1%	11.8%	12.0%	8.6%
24-35					
Male	26.1%	20.8%	21.3%	21.9%	28.1%
Female	24.6%	17.5%	23.4%	20.8%	23.8%
Total	25.5%	19.3%	22.2%	21.4%	25.9%
36-47					
Male	18.2%	18.0%	22.1%	19.5%	19.0%
Female	19.5%	18.5%	17.4%	18.3%	16.1%
Total	18.8%	18.2%	20.0%	19.0%	17.5%
48-59					
Male	11.7%	12.3%	10.7%	11.6%	11.3%
Female	11.0%	14.5%	10.4%	12.4%	16.8%
Total	11.4%	13.3%	10.6%	12.0%	14.2%
Total[a]					
Male	55.7% (454)	55.3% (535)	55.1% (396)	55.3% (1385)	47.9% (357)
Female	44.3% (365)	44.7% (435)	44.9% (316)	44.7% (1116)	52.1% (387)

[a] Percentages are weighted based on population proportions; actual number surveyed given in parentheses.