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EL SALVADOR NUTRITION STATUS SURVEYS

JANUARY - MARCH, 1978

and

JULY - SEPTEMBER, 1978

Carried out by the Maternal and Child Health Division of the Ministry of Health, El Salvador, with the collaboration of the Central America Research Station, Centers for Disease Control, United States Public Health Service, and in cooperation with the United States Agency for International Development.

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I. Introduction

The Government of El Salvador in collaboration with the Institute of Nutrition of Central America and Panama (INCAP) carried out two previous national nutrition surveys in El Salvador; one in 1965 (1) and the other in 1976 (2). Following the second survey, a Salvadorian nutrition status surveillance system was organized and began functioning in January, 1977 (3). The system is run and supervised by the Statistics Division of the Ministry of Health (MOH) with financial and technical assistance from the United States Agency for International Development (USAID) and the Central America Research Station (CARS). In order to evaluate the reliability of the clinic based surveillance data, two national nutrition surveys were completed during 1978 by the MOH and CARS in cooperation with USAID. The first was done from January to March, the time of lowest malnutrition prevalence, and the second survey from July to September, the time of highest malnutrition prevalence (4).

II. Objectives

There were three major objectives for the 1978 El Salvador Nutrition Status Surveys:

A. To provide statistically valid assessments of the protein-calorie nutritional status of the preschool population in the four major Salvadorian ecological regions in the seasons of lowest and highest prevalence of undernutrition. This was done by measuring certain crucial indicators of nutrition status in preschool children 6-59 months of age selected by a generally accepted survey sampling technique. These results are the focus of this report.

B. To provide statistically valid data on anemia in the preschool survey child and his mother. This data was collected on a 20 percent subsample of the total population surveyed during the second of the two 1978 surveys. The data provides country-wide estimation and comparison of anemia in preschool children by selected age groups and in mothers. It also gives an indication of the anemia prevalence in children and mothers among the four regions. These results have been presented in a previous report (5).

C. To evaluate the reliability of the Salvadorian Ministry of Health (MOH) surveillance system data in ranking the prevalence of malnutrition and diarrhea by region, and registering seasonal changes in nutritional status and diarrhea rates. Weight-for-age and diarrhea data obtained in the surveys will be assumed to represent the real nutrition and diarrhea status of the general

population and used as a base for comparison with MOH data in regional ranking and seasonal changes. These comparisons will be presented in a later report.

III. Survey Design and Methodology

A. Rationale

In the past, nutrition surveys have been complex undertakings. They collected an enormous amount of data which was often difficult to analyze. They were expensive, requiring a large, highly trained staff, much equipment and complicated techniques. A number of years often passed before the final report was issued and could be used for planning of programs. Another problem has been the lack of standardization, and hence comparability of surveys. As a result, the Eighth Joint Expert Committee of FAO and WHO of 1971 (6) emphasized the need for developing techniques to determine the worldwide prevalence of malnutrition and to make the results comparable from one country to another.

It has been shown that the degree of undernutrition in the preschool child is related to and can act as an indication of the level of the nutrition status of the total community (7). It has also been found that certain anthropometric measurements, selected clinical data and hemoglobin levels can be used as the key indicators of nutritional status in this high risk group (8,9). The Center for Disease Control has evolved a methodology for a simplified field assessment of nutritional status in developing countries based on these facts and the employment of probability sampling techniques (10). The latter selects survey children

in such a way that statistically valid estimates of the nutritional status of regions and comparisons among them can be made (11).

This methodology has been applied in ten countries over the past 5 years. Rapid assessments of the magnitude and geographical distribution of protein-calorie undernutrition and anemia have been obtained in these countries with a minimum of expense and within a short time (less than a year from inception to final report). It must be emphasized, however, that this methodology does not address the causes of the undernutrition found.

B. Core Data Items

In a field survey, the data items should adequately assess the nutritional conditions under consideration, should be easily measurable with acceptable accuracy and reliability, and must remain within the practical constraints of time, money, equipment, and personnel. Anthropometry allows one to assess protein-calorie undernutrition by using the simple body measurements of weight and height (and perhaps arm circumference).

These measurements rely on accurate age information for interpretation and to permit comparison with a reference population. In El Salvador a system of birth registration exists, but it was realized before field work began that this registration was not equally effective throughout the country. Because of this, a historical calendar was developed and the Salvadorian field workers were

trained in its use. The method of determining the age was recorded on each child's form so that the results could be analyzed according to the method of age determination.

The CDC/NCHS reference population (12) was used to analyze the anthropometric results from the two surveys. The contribution of ethnic differences in distorting anthropometric data comparisons between Salvadorian and U.S. reference populations is at a minimum within the 6-59 month age group (13).

With accurate height, weight, and age determinations and an acceptable reference population, the two major types of protein-calorie undernutrition can be distinguished; i.e., wasting which is a deficit of weight-for-height and a measurement of acute undernutrition, and stunting which is a deficit in height-for-age and a measurement of chronic undernutrition. Wasting requires a severe deficiency of both protein and calories of weeks to a few months. This is only seen in large numbers during a famine situation or other acute food shortage. Stunting requires a mild to moderate deficiency of both protein and calories for a much longer period. The distribution of weight-for-age measurements will also be presented, but this indicator does not distinguish between long-term stunting due to retarded linear growth of bones and short-term wasting of muscle and fat (14).

In summary, the following core data items were selected to evaluate protein-calorie undernutrition: weight, height, arm circumference and age. These items meet the criteria of ease of measurability

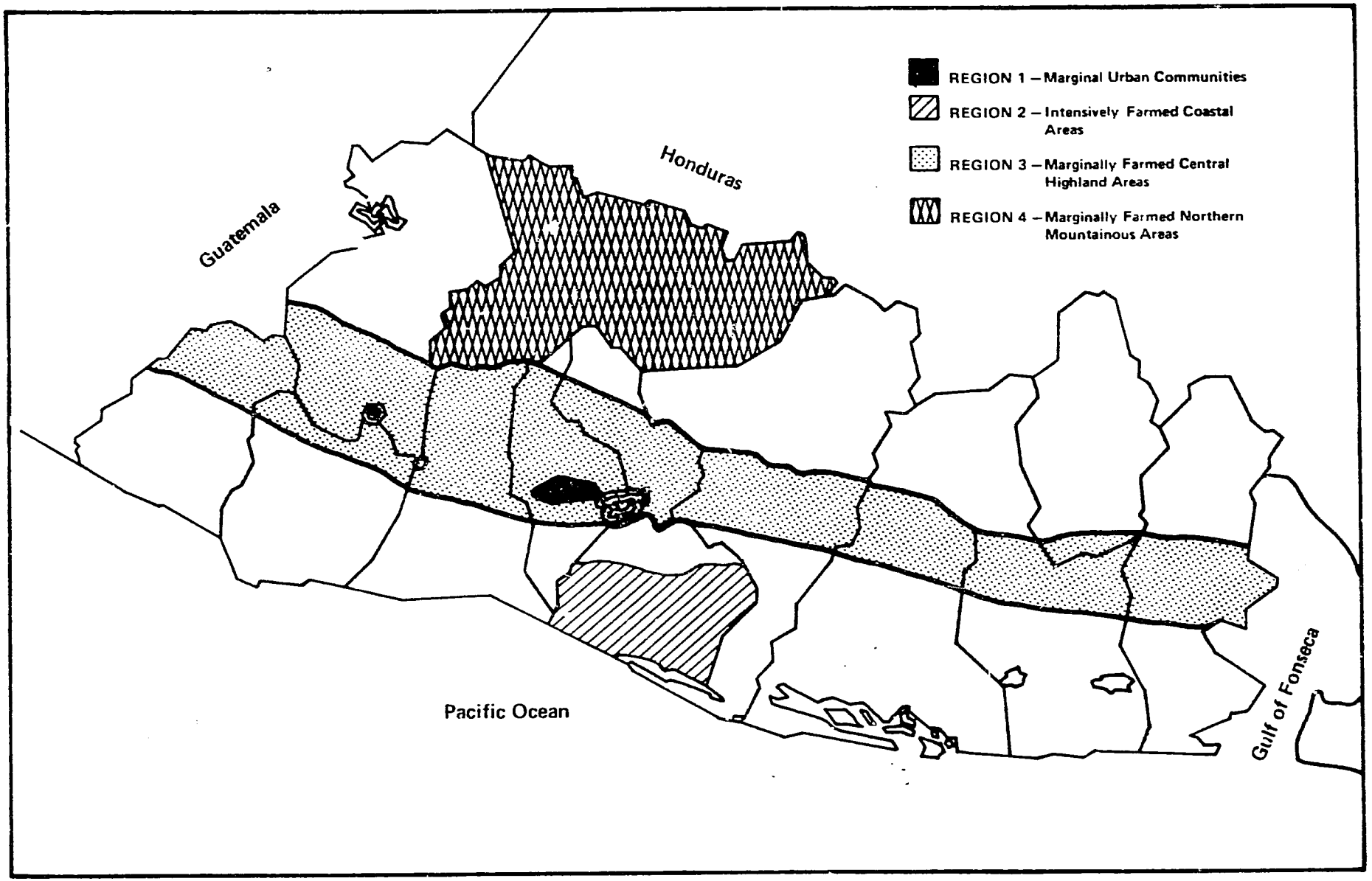
with acceptable accuracy and reliability and of adequate assessment of the nutritional conditions under consideration, while remaining within practical resource constraints.

C. Selection of Survey Universes

The survey universe was defined as the entire population of El Salvador (4.2 million by the 1971 census). The Institute of Nutrition of Central America and Panama (INCAP) divided the population of El Salvador into five major ecological regions during the 1976 Salvadorian National Nutrition Survey, based on the type of agricultural activity. These regions were: the marginal urban communities, the intensively farmed coastal areas, the marginally formed central highlands, the coffee growing areas of the central highlands and the marginally farmed northern mountains (2). Because of the similarity in nutritional status of the children in the 1976 survey in the coffee growing areas of the central highlands and in the marginally farmed central highlands, the coffee growing areas were eliminated from the 1978 surveys. The marginal urban communities of San Salvador represented the marginal urban communities, the coastal and hilly section of La Paz department represented the intensively farmed coastal areas, the marginally farmed central highlands was totally included and Chalatenango department represented the marginally farmed northern mountains (see Figure 1).

Samples were then drawn from each of the four regions so that the prevalence estimates for each region would have a precision above

FIGURE 1. MAP OF EL SALVADOR – SURVEY REGIONS



the predetermined minimally acceptable level and would allow regional comparisons from simple inspection of the data. Significance testing could then be directly performed to determine if significant differences in nutrition status existed among the regions (15).

Data was collected on a precoded form (see Appendix E). The field manual*describes in detail the training of the field teams and method of data collection.

D. Sampling Methods

Each region or sample area must consist of at least 30 clusters or sample sites to permit the estimation of protein-calorie under-nutrition (as well as other parameters examined by the study) at the regional level (15). Statistical testing could then determine if significant differences in nutrition parameters existed between regions. (A detailed description of these calculations is given in Appendix A.)

In the first stage of the sampling procedure, a minimum of 30 sample sites (villages or communities) were selected within each of the four regions using the 1971 census data. The probability of inclusion of a village or community in the sample was proportional to its population.

The second stage of the sampling procedure was carried out in the field by the individual teams. In each sample site, the first household was randomly chosen. Then the team proceeded to adjacent households until 30 children age 6-59 months were examined.(A detailed description of the sampling procedure is given in Appendix B).

*Obtainable from the Central America Research Station, San Salvador, El Salvador

E. Reference Population

An international reference population was used to standardize the El Salvador anthropometry data and to allow its comparison in the present two surveys and in future surveys using the same reference. The National Center for Health Statistics and Center for Disease Control (NCHS/CDC) reference population was selected because it is based on measurements made by well-trained personnel using standardized methods and on a large sample of American children examined within the past few years (12). (A further discussion of reference populations is presented in Appendix C.)

IV. Survey Results and Analysis

A. Analytic Methodology

Acute undernutrition was defined as a weight-for-height less than 85 percent of the reference median. Chronic undernutrition was defined as a height-for-age less than 90 percent of the reference median. Combined acute and chronic undernutrition was defined as a weight-for-height less than 85 percent of the reference median and a height-for-age less than 90 percent of the reference median. Three different categories of undernutrition are identified by the anthropometric parameters of height-for-age and weight-for-height. The percentage of preschool children in each category was calculated for each region. The regions were compared by undernutrition category to determine if significant variation among all regions existed using chi-square statistics (16). If significant variation existed, the t-test or chi-square test was performed to determine if the variation was accounted for by certain regions (16).

The above undernutrition categories have been used in other field surveys similar to this one in scope and purpose (17, 18, 19). One may object to the use of these somewhat arbitrary categories, and, for this reason, detailed distribution tables are presented in Appendix D which allows a closer inspection of the data. The use of a single cutoff value for acute and chronic undernutrition permits the presentation of straightforward analyses in the report and allows statistically meaningful, although simple, comparison of regions.

The sampling was done in such a way as to be proportional to the population (see Appendices A and B). This resulted in the sample size being slightly different among the regions and slight variations in precision do occur from region to region. However, the minimum number of clusters for the smallest region was 30, which maintains precision above the predetermined level even for this region. Larger regions will of course have a slightly greater level of precision.

B. Age and Sex Distribution

The sample distribution by sex and age for both surveys is shown in Tables 1a and 1b.

The age distribution for the total survey population in both surveys is not likely to have biased the survey results. There was, however, a preponderance of males in both surveys. There were significantly more males than expected in the first survey by the chi-square

Table 1a

Sample Distribution by Age and Sex

El Salvador: January-March, 1978

Age (Months)	Males		Females		Total	
	No.	Percent	No.	Percent	No.	Percent
6-11	254	6.9	196	5.3	450	12.1
12-23	417	11.3	391	10.6	808	21.8
24-35	425	11.5	383	10.3	808	21.8
36-47	418	11.3	397	10.7	815	22.0
48-59	460	12.4	364	9.8	824	22.2
Total	1,974	53.3	1,731	46.7	3,705	100.0

Table 1b

Sample Distribution by Age and Sex

El Salvador: July-September, 1978

Age (Months)	Males		Females		Total	
	No.	Percent	No.	Percent	No.	Percent
6-11	234	6.4	208	5.7	442	12.0
12-23	467	12.7	415	11.3	882	24.0
24-35	417	11.3	400	10.9	817	22.2
36-47	392	10.7	391	10.6	783	21.3
48-59	392	10.7	360	9.8	752	20.5
Total	1,902	51.7	1,774	48.3	3,676	100.0

test ($p < .01$). Although there were more males than females in the second survey, the difference was not statistically significant. The increased number of males probably represents the true sex distribution in preschool children in El Salvador and in any case does not introduce an important bias. (Sex differences in growth are very small in this age group.)

Of the 3,720 children selected for the first survey, 15 were excluded by the edit process. Of the 3,690 children selected for the second survey, 14 were excluded by editing.

C. Acute Undernutrition

Tables 2a and 2b show the percentage of children who had evidence of acute undernutrition ("wasting") in each region for each survey. The overall prevalences of 2.6 percent in the January - March survey and 3.1 percent in the July - September survey are relatively low and the increase between surveys is not statistically significant. Only one region, the Northern Marginal Agricultural, showed a statistically significant increase in acute undernutrition from the first to the second survey by the chi-square test ($p < .01$).

Tables 3a and 3b show the pattern of acute undernutrition by age groups for both surveys. Acute undernutrition in El Salvador is age related and is significantly higher in the children from 6-35 months in each survey by the chi-square test ($p < .001$). There is no difference in the age distribution of acute undernutrition between surveys.

Table 2a

Acute Undernutrition* by Region

El Salvador: January-March, 1978

Region	Percent Acutely Undernourished
Marginal Urban	1.7
Intensive Agricultural	4.0
Central Marginal Agricultural	2.8
Northern Marginal Agricultural	2.2
Average	2.6

*Weight-for-height < 85 percent of reference median.

Table 2b

Acute Undernutrition* by Region

El Salvador: July-September, 1978

Region	Percent Acutely Undernourished
Marginal Urban	1.0
Intensive Agricultural	4.1
Central Marginal Agricultural	2.8
Northern Marginal Agricultural	4.3
Average	3.1

*Weight-for-height < 85 percent of reference median.

Table 3a

Acute Undernutrition* by Age

El Salvador: January-March, 1978

Age (Months)	Percent Acutely Undernourished
6-11	4.2
12-23	4.2
24-35	3.2
36-47	1.6
48-59	0.7
Average	2.6

*Weight-for-height < 85 percent of reference median.

Table 3b

Acute Undernutrition* by Age

El Salvador: July-September, 1978

Age (Months)	Percent Acutely Undernourished
6-11	4.1
12-23	5.1
24-35	4.3
36-47	1.0
48-59	1.1
Average	3.1

*Weight-for-height < 85 percent of reference median.

Figures 2 & 3 display the El Salvador median weight-for-height for each survey as curves compared with the NCHS/CDC reference population median and 85 percent of median weight-for-height curves.

D. Chronic Undernutrition

Tables 4a and 4b show the percentage of children who had evidence of chronic undernutrition ("stunting") in each region for each survey. The total survey prevalence of stunting is high. Significant variation exists among the four regions in the July - September survey by the chi-square test ($p < .001$). No significant variation occurred among the four regions in the January - March survey. The Marginal Urban region has the lowest prevalence in each survey. There is a statistically significant increase in the prevalence in the Northern Marginal Agricultural region from the first to the second survey by the chi-square test ($p < .01$).

Tables 5a and 5b show the pattern of chronic undernutrition, by age, for each survey. The prevalence of stunting in El Salvador increased with age throughout the preschool period in each survey. Most of the increase occurred in the first three years of life.

Figures 4 & 5 compare for each survey the El Salvador median height-for-age curve with the NCHS/CDC reference median and 90 percent of median height-for-age curves.

E. Concurrent Acute and Chronic Undernutrition

Tables 6a and 6b show the percentage of children with evidence of concurrent acute and chronic undernutrition ("wasting and stunting") in each region for each survey. There is a significant variation between regions in each survey by chi-square analysis ($p < .025$). The only

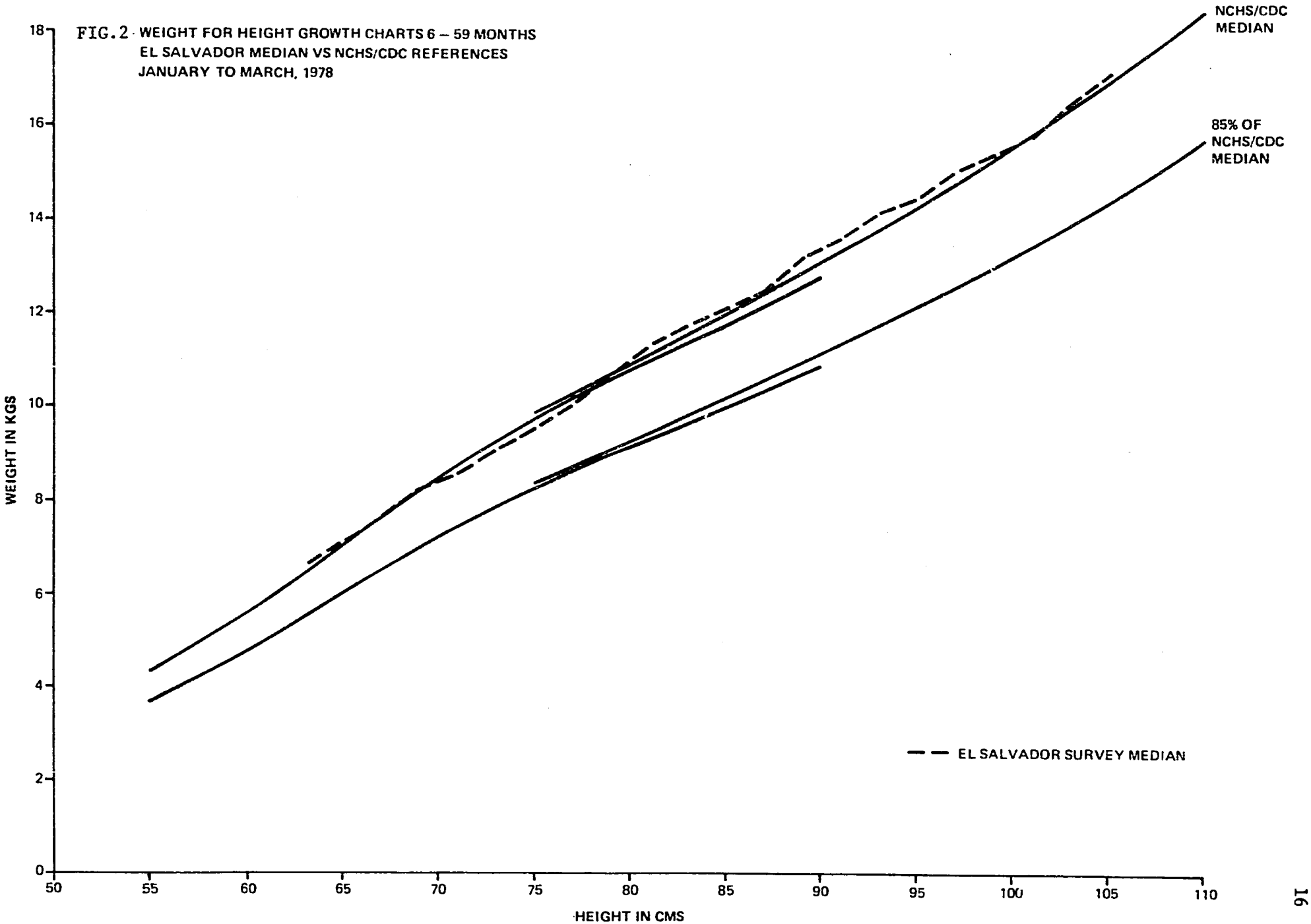


FIG. 2 · WEIGHT FOR HEIGHT GROWTH CHARTS 6 – 59 MONTHS
EL SALVADOR MEDIAN VS NCHS/CDC REFERENCES
JANUARY TO MARCH, 1978

FIG. 3 WEIGHT FOR HEIGHT GROWTH CHARTS 6 – 59 MONTHS
EL SALVADOR MEDIAN VS NCHS/CDC REFERENCES
JULY TO SEPTEMBER, 1978

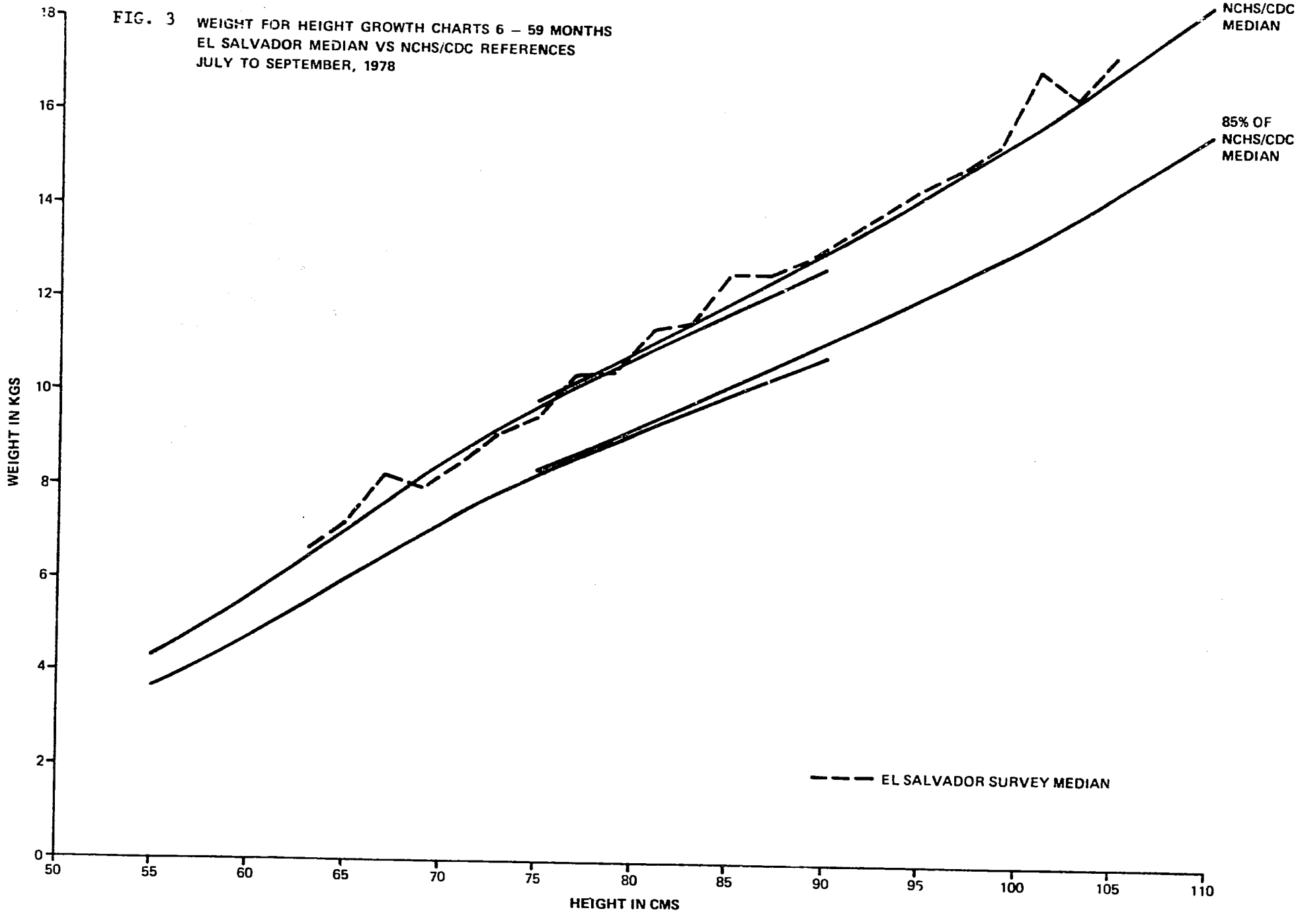


Table 4a

Chronic Undernutrition* by Region

El Salvador: January-March, 1978

Region	Percent Chronically Undernourished
Marginal Urban	26.9
Intensive Agricultural	29.1
Central Marginal Agricultural	30.4
Northern Marginal Agricultural	28.6
Average	28.7

*Height-for-age < 90 percent of reference median.

Table 4b

Chronic Undernutrition* by Region

El Salvador: July-September, 1978

Region	Percent Chronically Undernourished
Marginal Urban	25.6
Intensive Agricultural	26.6
Central Marginal Agricultural	31.5
Northern Marginal Agricultural	35.2
Average	29.8

*Height-for-age < 90 percent of reference median.

Table 5a

Chronic Undernutrition* by Age

El Salvador: January-March, 1978

Age (Months)	Percent Chronically Undernourished
6-11	6.7
12-23	22.2
24-35	32.7
36-47	34.6
48-59	37.1
Average	28.7

*Height-for-age < 90 percent of reference median.

Table 5b

Chronic Undernutrition* by Age

El Salvador: July-September, 1978

Age (Months)	Percent Chronically Undernourished
6-11	12.3
12-23	25.7
24-35	29.9
36-47	36.8
48-59	37.6
Average	29.8

*Height-for-age < 90 percent of reference median.

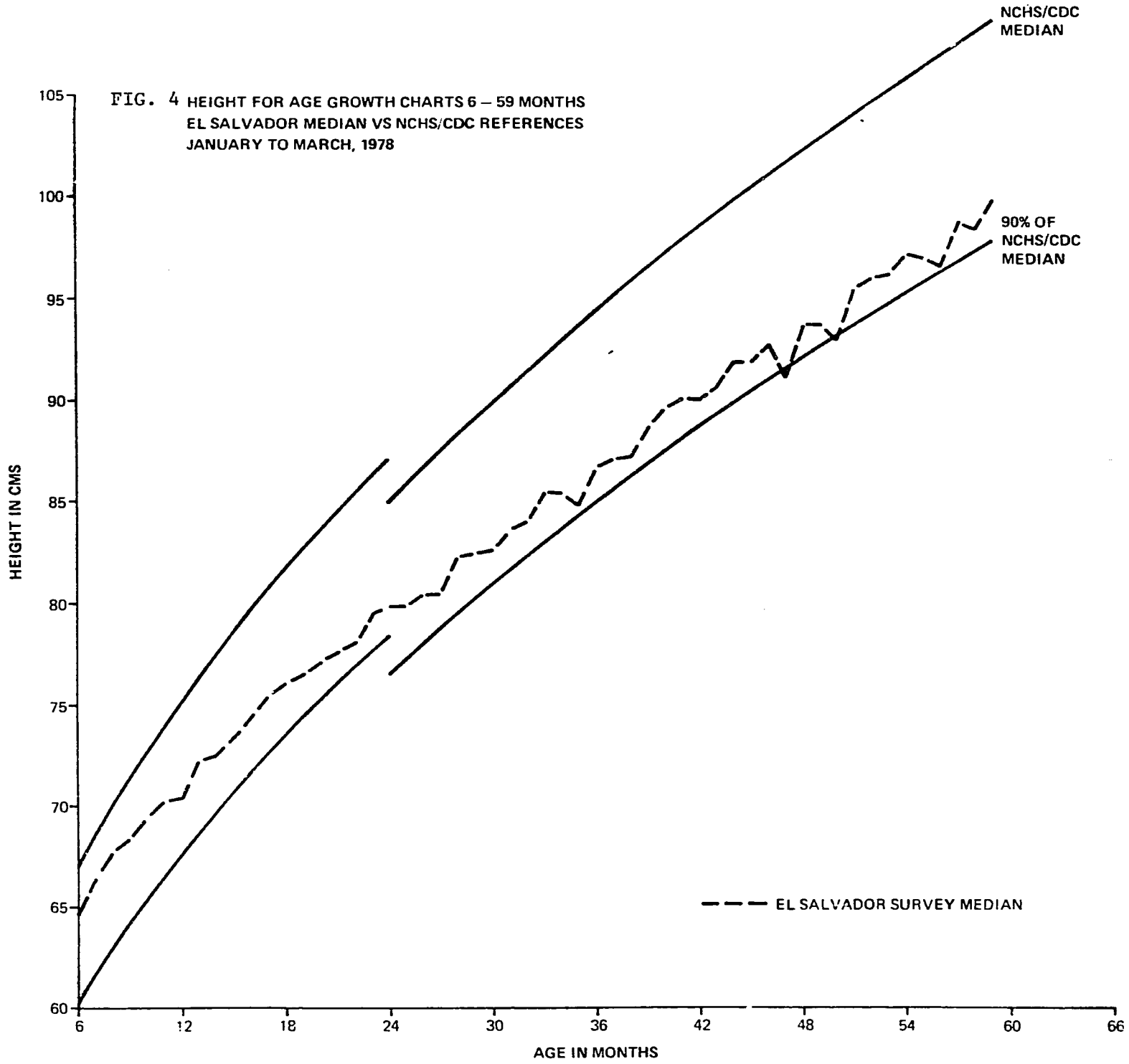


FIG. 4 HEIGHT FOR AGE GROWTH CHARTS 6 – 59 MONTHS
EL SALVADOR MEDIAN VS NCHS/CDC REFERENCES
JANUARY TO MARCH, 1978

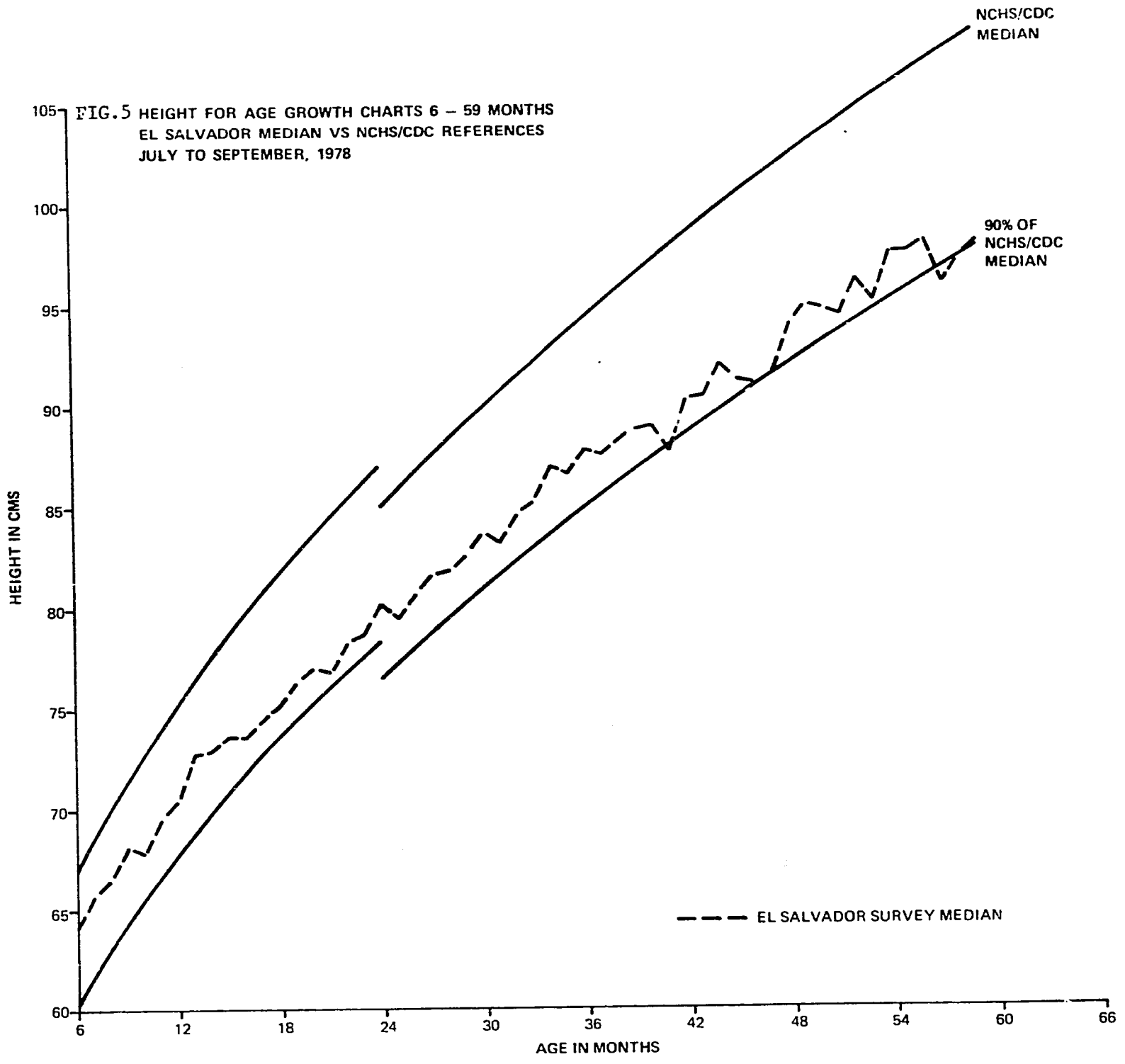


FIG. 5 HEIGHT FOR AGE GROWTH CHARTS 6 – 59 MONTHS
EL SALVADOR MEDIAN VS NCHS/CDC REFERENCES
JULY TO SEPTEMBER, 1978

Table 6a

Concurrent Acute and Chronic Undernutrition* by Region

El Salvador: January-March, 1978

Region	Percent Acutely and Chronically Undernourished
Marginal Urban	0.7
Intensive Agricultural	1.9
Central Marginal Agricultural	1.9
Northern Marginal Agricultural	0.8
Average	1.3

*Weight-for-height < 85 percent of reference median and height-for-age < 90 percent of reference median.

Table 6b

Concurrent Acute and Chronic Undernutrition* by Region

El Salvador: July-September, 1978

Region	Percent Acutely and Chronically Undernourished
Marginal Urban	0.4
Intensive Agricultural	1.8
Central Marginal Agricultural	1.4
Northern Marginal Agricultural	2.3
Average	1.5

*Weight-for-height < 85 percent of reference median and height-for-age < 90 percent of reference median.

significant increase from the first to the second survey occurred in the Northern Marginal Agricultural region ($p = <.01$, chi-square test). Overall in El Salvador the rate of concurrent acute and chronic undernutrition is low.

Tables 7a and 7b show the pattern of concurrent acute and chronic undernutrition by age groups in El Salvador. The pattern is that of low prevalence in all age groups, with highest prevalences in the second and third year of life.

F. Gómez Classification

While the Gómez classification (20), a weight-for-age index, does not allow one to distinguish between acute and chronic undernutrition, analyses based on weight-for-age are presented here since they may prove useful for comparison with previous data for El Salvador or for comparison with existing data from other countries. Tables 8a and 8b present the percent of children in combined second and third degree malnutrition by region according to the Gómez classification.

There is a significant variation among region prevalences in the July - September survey by chi-square analysis ($p <.001$). No significant variation occurred among region prevalences in the January - March survey. There also was a statistically significant increase in the overall prevalence of undernutrition by this parameter from the first to the second survey by the chi-square test ($p = <.01$). The Northern Marginal Agricultural region was the only region that showed a statistically significant increase from the first to the second survey ($p = <.001$, chi-square test).

Tables 9a and 9b show the age distribution of children with second and third degree malnutrition on a weight-for-age basis. A moderate prevalence of underweight-for-age children exists in all age groups

Table 7a
Concurrent Acute and Chronic Undernutrition* by Age
El Salvador: January-March 1978

Age (Months)	Percent Acutely and Chronically Undernourished
6-11	0.7
12-23	1.6
24-35	2.1
36-47	1.1
48-59	0.6
Average	1.3

*Weight-for-height <85 percent of reference median and height-for-age <90 percent of reference median

Table 7b
Concurrent Acute and Chronic Undernutrition* by Age
El Salvador: January-March 1978

Age (Months)	Percent Acutely and Chronically Undernourished
6-11	0.7
12-23	3.1
24-35	2.0
36-47	0.6
48-59	0.5
Average	1.5

*Weight-for-height <85 percent of reference median and height-for-age <90 percent of reference median

Table 8a

Gómez Classification: Combined Second and Third-Degree Malnutrition* by Region

El Salvador: January-March, 1978

Region	Percent Gómez Second and Third-Degree (Combined)
Marginal Urban	8.7
Intensive Agricultural	12.7
Central Marginal Agricultural	10.0
Northern Marginal Agricultural	10.8
Average	10.5

*Weight-for-age < 75 percent of reference median.

Table 8b

Gómez Classification: Combined Second and Third-Degree Malnutrition* by Region

El Salvador: July-September, 1978

Region	Percent Gómez Second and Third-Degree (Combined)
Marginal Urban	8.2
Intensive Agricultural	13.0
Central Marginal Agricultural	13.1
Northern Marginal Agricultural	17.2
Average	13.0

*Weight-for-age < 75 percent of reference median.

Table 9a

Gómez Classification: Combined Second and Third-Degree Malnutrition* by Age

El Salvador: January-March, 1978

Age (Months)	Percent Gómez Second and Third-Degree (Combined)
6-11	8.0
12-23	12.5
24-35	10.5
36-47	10.1
48-59	10.4
Average	10.5

*Weight-for-age < 75 percent of reference median.

Table 9b

Gómez Classification: Combined Second and Third-Degree Malnutrition* by Age

El Salvador: July-September, 1978

Age (Months)	Percent Gómez Second and Third-Degree (Combined)
6-11	11.1
12-23	16.1
24-35	11.9
36-47	12.3
48-59	12.4
Average	13.0

*Weight-for-age < 75 percent of reference median.

with a significant increase in each survey during the second year of life by the chi-square test ($p < .05$).

A more detailed presentation of the Gómez classification of the weight-for-age data is presented in Appendix D. Even though variations among regions can be demonstrated, the interpretation of the results does not allow the same objective targeted program planning as do weight-for-height and height-for-age data. These latter two indices separate acute and chronic undernutrition, and help to determine whether long or short-term intervention programs are indicated.

G. Arm Circumference-for-Height Data

Tables 10a and 10b present by region the distribution of the El Salvador preschool population in each survey by percent above and below 85 percent of the reference median. Those below 85 percent are considered to have acute undernutrition. There is significant variation among regions in each survey by the chi-square test ($p < .001$). The Urban Marginal region has the lowest prevalence in each survey. There is a significant increase in the prevalence from the first to the second survey in only the Northern Marginal Agricultural region by the chi-square test ($p < .01$).

Tables 11a and 11b present the age distribution of the El Salvador preschool children in each survey by percent above and below 85 percent of the reference median. Acute undernutrition peaks

Table 10a

Acute Undernutrition (as Measured by Arm Circumference-for-Height)* by Region

El Salvador: January-March, 1978

Region	Percent Acutely Undernourished
Marginal Urban	2.2
Intensive Agricultural	5.4
Central Marginal Agricultural	3.0
Northern Marginal Agricultural	2.9
Average	3.3

*Arm circumference-for-height < 85 percent of reference median.

Table 10b

Acute Undernutrition (as Measured by Arm Circumference-for-Height)* by Region

El Salvador: July-September, 1978

Region	Percent Acutely Undernourished
Marginal Urban	1.5
Intensive Agricultural	5.5
Central Marginal Agricultural	4.3
Northern Marginal Agricultural	5.3
Average	4.1

*Arm circumference-for-height < 85 percent of reference median.

Table 11a

Acute Undernutrition (as Measured by Arm Circumferenre-for-Height)* by Age

El Salvador: January-March, 1978

Age (Months)	Percent Acutely Undernourished
6-11	4.0
12-23	5.6
24-35	3.8
36-47	1.6
48-59	2.1
Average	3.3

*Arm circumference-for-height < 85 percent of reference median.

Table 11b

Acute Undernutrition (as Measured by Arm Circumference-for-Height)* by Age

El Salvador: July-September, 1978

Age (Months)	Percent Acutely Undernourished
6-11	2.4
12-23	7.0
24-35	4.5
36-47	2.4
48-59	3.1
Average	4.1

*Arm circumference-for-height < 85 percent of reference median.

in the second year of life in each survey. Acute undernutrition in the 6-35 month old age group is more prevalent than in those children over 3 years of age by the chi-square test ($p < .001$).

The distribution of the survey children by actual arm circumference values gives similar results if <12.5 cm is used as the cutoff point. The detailed distributions by region for each survey are presented in Appendix D.

In El Salvador, the prevalence and distribution of acute undernutrition using the arm circumference-for-height index parallels that found by weight-for-height. However, the reliability of arm circumference measurements is less than measurements of weight. In addition, acceptable arm circumference reference data are not available.

H. Influence of the Method of Age Determination on the Results

The determination of the survey child's age is the most important single factor in the validity of a nutrition status survey based on anthropometry. Only the measures of acute undernutrition by weight-for-height or arm circumference-for-height are age independent. All others require the comparison of the measured parameter to the subject's age.

Throughout the training period, the paramount need for accurate age determination of the children was stressed to the field workers. A verifiable record such as a birth registration document was to be sought. If this was not available, the field workers were to employ historical calendars to relate the child's birth to local

well known events. The first step was to determine in which month the birth occurred by use of recurring events such as harvests, plantings, etc. Then the year of birth was determined by use of well known important local events. Children without a verifiable record were not excluded from the survey except when the field workers felt that they could not arrive at the child's age within 3 months by the historical calendar method.

Tables 12a and 12b present the distribution of age determination methods by region. Less than 1/4 of the children in each survey had official records of their birth date available for inspection by the survey workers. Most of the records were kept by the local church. In each survey, the children in the marginal urban region had about twice the percent of ages determined by a verifiable record as the rural regions ($p < .001$, chi-square test).

In order to arrive at some idea of the accuracy of the age data obtained by the historical calendar, one of the age dependent measurements (height-for-age or chronic undernutrition) was calculated by grouping the children according to the method by which their age was determined. Tables 13a and 13b present these results. There is no statistical difference in chronic undernutrition calculated by the two methods of age determination except for the Northern Agricultural region during the July-September survey ($p < .02$, chi-square test). In El Salvador the historical calendar method of age determination of preschool children had sufficient accuracy, except in the Northern Marginal Agricultural region during the July-September survey.

Table 12a

Age Determination Method by Region

El Salvador: January-March, 1978

Region	Percent by Verifiable Record	Percent by Historical Calendar Method
Marginal Urban	33.4	66.6
Intensive Agricultural	23.8	76.2
Central Marginal Agricultural	20.8	79.2
Northern Marginal Agricultural	16.5	83.5
Average	23.7	76.3

Table 12b

Age Determination Method by Region

El Salvador: July-September, 1978

Region	Percent by Verifiable Record	Percent by Historical Calendar Method
arginal Urban	36.0	64.0
ntensive Agricultural	16.9	83.0
entral Marginal Agricultural	18.7	81.3
orthern Marginal Agricultural	16.5	83.5
verage	22.1	77.8

Table 13a
Chronic Undernutrition*
by Age Determination Method by Region

El Salvador: January-March 1978

Region	% Chronically Undernourished		
	Verifiable Record	Historical Calendar Method	Total
Marginal Urban	27.3	26.7	26.9
Intensive Agricultural	31.8	28.4	29.2
Central Marginal Agricultural	28.4	31.1	30.5
Northern Marginal Agricultural	24.4	29.6	28.7
Average	28.0	28.9	28.7

*Height-for-age <90 percent of reference median

Table 13b
Chronic Undernutrition*
by Age Determination Method by Region

El Salvador: July-September 1978

Region	% Chronically Undernourished		
	Verifiable Record	Historical Calendar Method	Total
Marginal Urban	25.2	26.1	25.8
Intensive Agricultural	27.0	26.4	26.5
Central Marginal Agricultural	29.5	32.3	31.8
Northern Marginal Agricultural	26.6	37.1	35.3
Average	26.6	30.9	30.0

*Height-for-age <90 percent of reference median

I. Rural and Urban Sectors

In Table 14 the data is arranged to allow comparison of the urban, rural and country-wide values. Of the total population of 3,705 children included in the analysis of the January-March, 1978 survey, 2,716 or 73.3 percent were in the rural regions and 989 or 26.7 percent were in the urban region. Of the total population of 3,676 children included in the analysis of the July-September, 1978 survey, 2,719 or 74.0 percent were in the rural regions and 957 or 26.0 percent were in the urban regions. The two indices of acute undernutrition show about a two-fold higher prevalence in the rural areas. This difference is more marked in the July-September survey (using chi-square analysis, $p = <.001$ for the urban-rural difference in this survey for each of the two indices). The urban-rural difference in chronic undernutrition is statistically significant by the chi-square test ($p <.001$) in the July-September survey, but the difference is not significant in the January-March survey.

In summary, the rural sector has a higher prevalence of undernutrition than the urban sector as measured by each of the indices in Table 14. These differences are more marked in the July-September survey.

Table 14

Comparison of Urban and Rural Sectors
by Undernutrition Indexes*
El Salvador: 1978

Undernutrition Indexes	January-March Survey			July-September Survey		
	Urban	Rural	Country-Wide	Urban	Rural	Country-Wide
% Acute Undernutrition	1.7	3.0	2.6	1.0	3.8	3.1
% Chronic Undernutrition	26.9	29.3	28.7	25.6	31.3	29.8
% Concurrent Acute & Chronic Undernutrition	0.7	1.5	1.3	0.4	1.9	1.5
% Gómez $2^{o}+3^{o}$	8.7	11.2	10.5	8.2	14.7	13.0
% Low Arm Circumference-for-Height	2.2	3.7	3.3	1.5	5.1	4.1

*See definitions in previous text

V. Discussion

The 1978 El Salvador Nutrition Status Surveys were cross-sectional studies of the four major ecological population groupings. The ideal requirements of the statistician and the realities of field logistics, time, and available funding, were carefully considered in determining the survey data content and sampling methods. Another major reason for choice of the sample frame was to make possible the comparison of the data from these surveys with those obtained in the 1976 INCAP survey in El Salvador (2). The sample frame used in the 1965 INCAP survey did not permit regional comparisons and was different in many other ways from the 1976 and present sample frames.

The simple division of children into well nourished and malnourished on the basis of any single anthropometric parameter can be misleading. No single anthropometric parameter quantitates completely the individual contributions of the acute and chronic components of undernutrition in a population. The deficient weight of a child in comparison with the ideal weight for his height provides an indication of acute undernutrition. Height deficits in children are nearly always an indication of the long duration of undernutrition. The Waterlow classification provides a method of cross-tabulating these two components of protein-energy undernutrition (14).

The classification of undernutrition into acute and chronic components is important in that each has different implications for the design and evaluation of appropriate remedial programs. Acute undernutrition, or

wasting, suggests current or recent deficiency in available nutrients, reflecting inadequate food intake, impaired absorption resulting from diarrhea, increased metabolic demands of other acute disease, or a combination of these factors. While it may be difficult to rapidly change the prevalence of these three situations, the first may respond to a quickly instituted short-term remedial program. This is particularly true in famine where emergency food distribution can remedy the situation until the acute environmental problems normalize.

Chronic undernutrition, or stunting, implies past and long-term nutritional inadequacies of food intake, a more subtle nutritional deprivation that retards linear growth. (An unknown factor in the prevalence of stunting relates to the prevalence of chronic diseases or repeated attacks of acute diseases, both of which will influence stature growth.) Mortality and morbidity resulting from chronic undernutrition are not as measurable or as impressive as those from acute undernutrition. Furthermore, the implications of a moderate deficit in height potential on a child's health are not known. Long-term and multisectorial approaches to the design and implementation of remedial programs are required to improve the chronic undernutrition problem of a population. The benefits of such programs may take several years to be realized.

Protein-energy undernutrition is a general problem in the age group surveyed in El Salvador, the magnitude and nature of which differ in various sectors and by season, as summarized in Tables 15a and 15b.

Table 15a
El Salvador Nutrition Status Survey Summary:
Percentage Distribution of Children 6-59 Months
of Age by Waterlow Categories
El Salvador: January-March 1978

	Percentage in Waterlow Categories				
	Normal	Wasting Only	Stunting Only	Wasting and Stunting	Sample Sizes
Total El Salvador	69.8	1.4	27.5	1.3	3,705
Rural	69.1	1.5	27.9	1.5	2,716
Urban	72.1	1.0	26.2	0.7	989
NAS Reference Population*	98.7	0.8	0.5	-	6,195

*An American reference population recommended by the National Academy of Sciences, developed by CDC, and similar to the NCHS/CDC reference population.

Table 15b
El Salvador Nutrition Status Survey Summary:
Percentage Distribution of Children 6-59 Months
of Age by Waterlow Categories
El Salvador: July-September 1978

	Percentage in Waterlow Categories				
	Normal	Wasting Only	Stunting Only	Wasting and Stunting	Sample Sizes
Total El Salvador	68.4	1.6	28.5	1.5	3,676
Rural	66.6	1.9	29.6	1.9	2,719
Urban	73.6	0.6	25.4	0.4	957
NAS Reference Population*	98.7	0.8	0.5	-	6,195

*An American reference population recommended by the National Academy of Sciences, developed by CDC, and similar to the NCHS/CDC reference population.

Chronic undernutrition is much more of a problem than acute undernutrition in El Salvador. In fact, even in the season of high undernutrition (July - September), acute undernutrition increased by only a small amount.

Acute undernutrition, or wasting, as measured by the weight-for-height index, varies in prevalence among the regions of El Salvador. The country averages of 2.6 percent in the January - March survey and 3.1 percent in the July - September survey represent the combined effects of inadequate food intake and physiological nutrient misutilization resulting primarily from acute infectious disease. The individual contribution of these two factors is unknown. In addition, the contribution of each factor varies with the seasons of the year. For instance, analysis of the data on diarrhea prevalence collected during these two surveys shows that diarrhea increased significantly in each of the four regions from the first to the second survey. However, there was a significant increase in the prevalence of acute undernutrition between surveys in only one region, the Northern Marginal Agricultural region (22). Therefore, the marked change in the acute nutritional status seen in this region in July - September was more likely due to a seasonal decrease in food availability than to increases in diarrhea, the major infectious disease during this season.

Although the statistical differences for prevalence of acute undernutrition between regions are significant, a practical interpretation of the differences must consider that the country average is only 2 - 3 percent and that only an arbitrary decision can establish the level of acute undernutrition at which intervention is required. The prevalence in the acute famine situation in the Sahel in 1975 ranged from 9.1 percent to 22.5 percent (23). The values for El Salvador were much below this, which indicates that acute famine did not exist in El Salvador at the time of these surveys. However, both the Intensive Agricultural and Northern Marginal Agricultural populations may be at higher risk in a situation of severe food scarcity.

In El Salvador, distribution of acute undernutrition by age groups indicates that children under 3 years of age are most seriously affected. Because acute lack of food would affect all age groups, the identification of much higher rates of acute undernutrition in children under 3 indicates the influence of certain age-related factors: inadequate weaning foods and techniques, the inability of the child to compete successfully in the family food chain, and the high risk of infectious diseases. The contributions of these factors must be considered in designing a remedial program targeted at this age group.

There is a high level of chronic undernutrition, or stunting, as measured by the height-for-age index, in all regions of El Salvador. The country average was 28.7 percent in January - March and 29.8 percent in July - September. This is higher than the 19.1 percent prevalence seen in a CDC

survey in Togo (19) and the 23.6 percent prevalence seen in another CDC survey in Haiti (24). Both of these surveys used the same techniques as the present El Salvador surveys. It is also of interest to contrast the El Salvador prevalences with the 0.5 percent prevalence seen in a United States reference population (see Tables 15a and 15b).

There was significant variation in the prevalence of chronic undernutrition among regions in the July - September survey, but not in the January - March survey. Most of this variation was accounted for by the increase in prevalence in the Northern Marginal Agricultural region. The increase in this region may have been due to an increased error rate in age determination in this region during the second survey (see table 13b). The survey workers believed that most errors in age determination were in overestimation of the true age. This would lead to an increased rate of chronic undernutrition as seen in the Northern Marginal Agricultural region in the July - September survey.

In El Salvador, stunting begins in the first year of life and the prevalence dramatically increases during the next 2 years. The increase is much slower in the fourth and fifth years of life. Much of the rapid increase in the second and third years of life is probably due to inadequate weaning methods and high rates of infectious disease. These factors are less important after the third year of life. Also, nutrition may be adequate enough by a child's fourth year to prevent many new children from entering this category, but not adequate enough to permit any catch-up growth.

Because the effect of stunting on the health or well-being of a child is not well understood, the practical importance of these findings is hard to interpret. One exception is the evidence from these surveys that there is a 5-fold higher risk of anemia in chronically undernourished children than in normally growing children (5). This finding suggests that the same factors are causing both stunting and anemia in El Salvador. The most important common factor is probably the long-term cumulative effect of low dietary intake of protein, calories, and iron. This, in turn, is due to problems in agricultural production, food distribution, and market prices. Other factors would be the role of cash crops and socioeconomic divisions in El Salvador. Data on the contribution of each factor to the prevalence of stunting are not available from these surveys. Some information on the importance of individual factors in the light of the prevalence data of these surveys may be obtainable from the records of various ministries.

If, as Waterlow suggests, children suffering from concurrent wasting and stunting require a priority response, then about 1.4 percent of El Salvador's 860,467 children 6 - 59 months of age (12,046 children) have priority needs (14). These children are suffering the combined effects of an acute deficit in nutrients and of long-term protein-energy undernutrition. When the distribution of the prevalence of this category of undernutrition is analyzed, statistical differences are evident among regions and among age groups. The only significant increase in concurrent wasting and stunting from the first to the second survey occurred in the Northern Marginal Agricultural region.

Weight-for-age is the most commonly used index of undernutrition. This parameter does not identify the separate contributions of acute and chronic protein-energy deficits. In El Salvador, 10.5 percent in the January - March survey and 13.0 percent in the July - September survey of the children 6-59 months of age are in the combined second- and third-degree Gómez classification. In both surveys, the urban region had significantly less undernutrition by this index than the remaining regions. There was a statistically significant difference in the prevalence among regions in the July - September survey, but not in the January - March survey. This difference in the July - September survey is mostly due to the large increase in prevalence in the Northern Marginal Agricultural region. As discussed previously, this may largely be due to errors in over estimating age in this region during this survey. In El Salvador where there is a high prevalence of chronic undernutrition and a relatively low prevalence of acute undernutrition, a large proportion of undernutrition as defined by the Gómez system of weight-for-age measurements may be related to long-term causes; i.e. chronic deficits in food, recurrent episodes of illness, etc.

Tables 16a and 16b summarize the regional differences for protein- energy undernutrition by presenting a ranking of regions as determined by totaling the regional rankings for the three commonly used growth indices of weight-for-height, height-for-age, and weight-for-age. These results indicate that the Marginal Urban region had the least undernutrition in both surveys and show that the Intensive Agricultural region had the most

Table 16a
Summary Regional Ranking for Undernutrition:
A Combination of Regional Growth Rankings
for Weight-for-Height, Height-for-Age, and Weight-for-Age
El Salvador: January-March 1978

Region	Total Ranking Value
1 Marginal Urban	3
2 Northern Marginal Agricultural	7
3 Central Marginal Agricultural	9
4 Intensive Agricultural	11

Table 16b
Summary Regional Ranking for Undernutrition:
A Combination of Regional Growth Rankings
for Weight-for-Height, Height-for-Age, and Weight-for-Age
El Salvador: July-September 1978

Region	Total Ranking Value
1 Marginal Urban	3
2 Intensive Agricultural	7
3 Central Marginal Agricultural	8
4 Northern Marginal Agricultural	12

undernutrition in the January - March survey, while the Northern Marginal Agricultural region had the most undernutrition in the July - September survey.

The measurement of arm circumference has been advocated as a useful parameter to assess nutrition status, and the arm circumference-for-height index has been used to identify acute undernutrition. In El Salvador, arm circumference-for-height ranks the regions in both surveys almost identically to that of the weight-for-height index.

However, the weight-for-height index is believed to be the better anthropometric indicator of acute undernutrition. Weaknesses in arm circumference data arise because this measurement is less accurate than weighing and because the reference data for arm circumference need further development. Arm circumference measurement in preschoolchildren might find its greatest usefulness when screening is done for acutely undernourished preschoolchildren in a famine or other disaster, rather than in baseline surveys or program evaluations.

The survey results indicate real differences in nutrition status of the preschool population between the rural and urban sectors of El Salvador. The rural sector has the poorest nutrition status by all survey anthropometric indices. This indicates the urgent need to concentrate interventions in the rural areas.

The data from the two 1978 surveys are compared in Tables 17, 18, and 19 with those of similar anthropometric surveys carried out by INCAP in El

Table 17
Comparison of the 1965 and 1976 INCAP Survey Results (1,2) to the 1978 Survey Results - Children 6-59 Months of Age
Acute Undernutrition or Weight-for-Height

	Percent of Reference Median			
	<80.0	80.0-89.9	90.0-99.9	100.0+
INCAP, Sept.-Nov. 1965	3.2	13.7	42.8	40.4
INCAP, June-Aug. 1976	2.1	16.5	43.8	37.6
CARS, Jan.-March 1978	0.7	7.8	38.2	53.3
CARS, July-Sept. 1978	0.9	8.7	39.4	51.0

Table 18
Comparison of the 1965 and 1976 INCAP Survey Results (1,2) to the 1978 Survey Results - Children 6-59 Months of Age
Chronic Undernutrition or Height-for-Age

	Percent of Reference Median			
	<85.0	85.0-89.9	90.0-94.9	95.0+
INCAP, Sept.-Nov. 1965	15.4	28.3	37.2	18.0
INCAP, June-Aug. 1976	13.0	27.8	36.1	23.1
CARS, Jan.-March 1978	6.6	22.0	42.5	28.9
CARS, July-Sept. 1978	6.7	23.2	42.4	27.7

Table 19
Comparison of the 1965 and 1976 INCAP Survey Results (1,2) to the 1978 Survey Results - Children 6-59 Months of Age
Gómez Classification or Weight-for-Age

	Percent of Reference Median			
	3° <60.0	2° 60.0-74.9	1° 75.0-89.9	Normal 90.0+
INCAP, Sept.-Nov. 1965	3.2	24.5	50.5	21.8
INCAP, June-Aug. 1976	1.8	18.2	51.8	28.2
CARS, Jan.-March 1978	0.7	9.9	49.3	40.1
CARS, July-Sept. 1978	0.9	12.1	51.2	35.8

Salvador in 1965 and 1976. There appears to have been a decrease in the prevalence of both acute and chronic undernutrition from 1965 to 1978. This decrease in the prevalence of undernutrition is even more marked for the Gómez or weight-for-age index, since this index is composed of both the acute and chronic components of undernutrition.

One problem in comparing the previous INCAP surveys with the 1978 surveys is that different reference populations were used to calculate the anthropometric indices. Other problems are that the sampling frame was very different in the 1965 survey, resulting in a more urbanized sample, and the 1965 survey was done later in the year than the other surveys. Both factors would tend to lower the prevalence of undernutrition found in this survey and cause an underestimation in the degree of improvement since 1965.

In any case, the levels of undernutrition, especially chronic undernutrition, were still unacceptably high in 1978. New interventions and continuation of present programs are needed to continue the gains already achieved in improving the nutrition status of the preschoolchild in El Salvador.

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Appendix A - Determination of Survey Sample Size

A number of factors enter into the determination of sampling specifics for a statistical study, including:

a. Resources available, both financial and physical.

b. Constraints such as time and logistical problems affecting the survey in the field.

c. The nature of the sample distribution assumed applicable.

d. The precision desired and the confidence level to be associated with it.

Considering the effect of these factors on the survey, a minimum of 30 sample sites or clusters in each region allows the use of normal parametric statistical procedures in the estimation of population characteristics* of a sample region and in testing for a significant statistical difference among them (15).

For survey purposes, El Salvador was divided into four ecological regions, each being considered as a separate sampling area. A sample was drawn independently for each region.

A random start and a fixed interval method for population proportional sampling was then applied to the 1971 El Salvador population lists to identify the rural villages or urban quarters that became the actual sample sites in each region. This procedure is fully explained in Appendix B.

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

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') (21).

Z = normal deviate for confidence level desired (1.96 for 95% confidence and 1.64 for 90% 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:

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

Past experience has shown that K = 2 should provide at least the desired precision for most variables. 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:

$$K = 2 \text{ (cluster effect)}$$

$$Z = 1.96 \text{ (95\% confidence)}$$

$$p = 0.5 \text{ (50\%)}$$

$$D = .046 \text{ (4.6\%)}$$

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

$$n = 900$$

Since a minimum of 900 children and a minimum of 30 clusters are necessary for an acceptable level of precision for each region, 30 children become the size of each sample unit.

A region 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 (p1 - p2)
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 regions 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 (p1 - p2) (21).

Predetermination of the sample size did 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.

Appendix B - Selection of Sample Sites and Survey Children

A two stage cluster sampling procedure was used in the surveys. In the first stage the sample sites were preselected by a population proportionate method based on the 1971 Salvadorian population census. In each region, all villages were listed and their populations cumulated. The sampling interval was determined by dividing the total population of a region by the number of sample sites required; i.e., 30. A village was randomly selected as the starting point and the sampling interval added sequentially to the cumulated population until the total number of sites had been selected.

The second stage was carried out on arrival of the survey team at the sample site. In the rural areas, malaria housing maps were available. The first house was selected by using a random number table. A compass direction was then selected to determine the direction of subsequent houses. On reaching the geographic limits of the village, the team worked in a clockwise direction and back toward the first house. This procedure was continued until 30 children had been included. In the urban area, no maps were available. To select the first house, the geographical center of the community was selected. A compass direction was selected as above. The number of houses between the center and limits of the sample site in the direction selected was estimated. The first house among these was selected by using a random number table. Subsequent houses were then selected as in the rural areas until 30 children had been included.

Appendix C - Reference Population for Anthropometry

Reference populations used in anthropometry are frequently criticized as not being applicable to developing areas of the world. In preschool-age growth studies, the influences of environment, such as nutrition and infectious disease, are of much greater importance than those of race or ethnicity. The differences in growth of preschool children associated with social class are many times those attributable to ethnic factors alone. The probable degrees of the genetic effect on height-for-age and weight-for-age growth indices are approximately three percent and six percent, respectively, among children from different ethnic backgrounds but similar socio-economic class. In pre-pubertal children, weight-for-height indices are relatively independent of age and race and chiefly reflect nutritional status.

Waterlow suggests that a reference be used as a basis for a value judgement. The reference population values are correctly used as a basis for the interpretation of survey results and are not to be used as a standard or target to be sought after by a country.

Two or more studied populations or repeated studies on one population can be compared if a reference population is decided on and if the criteria for subject inclusion, age determination and measurement methodology are the same. Although several reference populations are available for anthropometry, the so-called Stuart-Meredith populations, based on data collected on a relatively small number of children in Iowa and Boston during the 1930's and early 1940's, are most commonly utilized as a reference.

Specific limitations of the Stuart-Meredith data base are the small numbers of children involved, the longitudinal rather than cross-sectional gathering of data, the limited socio-economic and ethnic representation, and the age of the data itself. The 10th and 90th percentile were based on such a small number of people as to severely limit statistical precision in these ranges. In developing areas, a great majority of individuals may fall below the 10th percentile, the very area where the Stuart-Meredith data base is statistically the weakest.

The recent availability of data from large-scale and more representative studies in the U.S. has resulted in more appropriate references for use in population comparisons, known as the National Center for Health Statistics/Center for Disease Control (NCHS/CDC) reference populations for anthropometry. Specifically, the larger number of individuals characterizing the NCHS/CDC reference population improves the statistical precision of outlying percentiles.

The general acceptance of a reference population for anthropometry is an international need. The choice of which reference to use for a single survey is probably unimportant. However, if multiple surveys are to be compared, it would seem reasonable that a single reference be agreed upon.

Appendix D - Detailed Distributions of El Salvador Anthropometric Indices

Ia. Percentage Distribution of January-March 1978 Survey Population by the Weight-for-Height Index by Region

Region	Percent of NCHS/CDC Reference Median				
	<80.0	80.0-84.9	85.0-89.9	90.0-99.9	100.0+
Marginal Urban	0.5	1.2	5.5	34.6	58.2
Intensive Agricultural	0.8	3.2	6.6	39.2	50.2
Central Marginal Agricultural	0.9	1.9	5.2	39.2	52.8
Northern Marginal Agricultural	0.8	1.4	6.4	40.0	51.4
Average	0.7	1.9	5.9	38.2	53.3

Ib. Percentage Distribution of July-September 1978 Survey Population by the Weight-for-Height Index by Region

Region	Percent of NCHS/CDC Reference Median				
	<80.0	80.0-84.9	85.0-89.9	90.0-99.9	100.0+
Marginal Urban	0.2	0.8	4.5	34.8	59.7
Intensive Agricultural	1.2	2.9	8.3	42.3	45.3
Central Marginal Agricultural	0.6	2.2	6.1	38.3	52.8
Northern Marginal Agricultural	1.4	2.9	7.2	41.9	46.6
Average	0.9	2.2	6.5	39.4	51.0

IIa. Percentage Distribution of January-March 1978 Survey Population by the Weight-for-Height Index by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median				
	<80.0	80.0-84.9	85.0-89.9	90.0-99.9	100.0+
6-11	0.7	3.6	6.5	34.5	54.7
12-23	1.1	3.1	9.7	40.4	45.7
24-35	0.7	2.5	5.9	40.1	50.8
36-47	0.7	0.9	3.8	34.7	59.9
48-59	0.4	0.4	4.1	39.5	55.6
Average	0.7	1.9	6.0	38.2	53.2

IIb. Percentage Distribution of July-September Survey Population by the Weight-for-Height Index by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median				
	<80.0	80.0-84.9	85.0-89.9	90.0-99.9	100.0+
6-11	1.8	2.3	5.7	36.7	53.5
12-23	1.5	3.6	10.5	43.7	40.7
24-35	1.1	3.2	6.3	39.8	49.6
36-47	0.3	0.8	4.7	36.5	57.7
48-59	0.1	0.9	4.5	38.6	55.9
Average	0.9	2.2	6.5	39.4	51.0

IIIa. Percentage Distribution of January-March 1978 Survey Population by the Height-for-Age Index by Region

Region	Percent of NCHS/CDC Reference Median				
	<85.0	85.0-89.9	90.0-94.9	95.0-99.9	100.0+
Marginal Urban	5.9	21.1	42.2	24.6	6.2
Intensive Agricultural	6.8	22.3	43.3	21.2	6.4
Central Marginal Agricultural	6.5	23.9	42.8	21.9	4.9
Northern Marginal Agricultural	7.3	21.3	41.7	25.2	4.5
Average	6.6	22.0	42.5	23.4	5.5

IIIb. Percentage Distribution of July-September 1978 Survey Population by the Height-for-Age Index by Region

Region	Percent of NCHS/CDC Reference Median				
	<85.0	85.0-89.9	90.0-94.9	95.0-99.9	100.0+
Marginal Urban	4.7	20.9	39.0	28.9	6.5
Intensive Agricultural	6.4	20.2	41.9	24.8	6.7
Central Marginal Agricultural	6.7	24.8	46.5	18.7	3.3
Northern Marginal Agricultural	8.7	26.6	42.8	18.0	3.9
Average	6.7	23.2	42.4	22.6	5.1

IVa. Percentage Distribution of January-March 1978 Survey Population by the Height-for-Age Index by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median				
	<85.0	85.0-89.9	90.0-94.9	95.0-99.9	100.0+
6-11	0.9	5.8	35.7	41.1	16.5
12-23	3.7	18.4	44.5	29.2	4.2
24-35	6.4	26.3	43.7	20.1	3.5
36-47	9.0	25.6	43.3	17.1	5.0
48-59	10.4	26.7	42.1	17.5	3.3
Average	6.6	22.0	42.5	23.4	5.5

IVb. Percentage Distribution of July-September 1978 Survey Population by the Height-for-Age Index by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median				
	<85.0	85.0-89.9	90.0-94.9	95.0-99.9	100.0+
6-11	1.6	10.7	38.6	40.5	8.6
12-23	4.6	21.2	45.8	22.1	6.3
24-35	6.7	23.2	40.2	25.1	4.8
36-47	10.0	26.8	42.0	16.7	4.5
48-59	8.6	29.0	43.2	16.4	2.8
Average	6.7	23.2	42.4	22.6	5.1

Va. Percentage Distribution of January-March 1978 Survey Population by the Weight-for-Age Index (Gómez Classification) by Region

Region	Percent of NCHS/CDC Reference Median - Gómez Classification			
	3° <60.0	2° 60.0-74.9	1° 75.0-89.9	Normal 90.0+
Marginal Urban	0.7	8.0	45.8	45.5
Intensive Agricultural	1.0	11.7	49.2	38.1
Central Marginal Agricultural	0.8	9.2	51.4	38.6
Northern Marginal Agricultural	0.3	10.5	51.1	38.1
Average	0.7	9.9	49.3	40.1

Vb. Percentage Distribution of July-September 1978 Survey Population by the Weight-for-Age Index (Gómez Classification) by Region

Region	Percent of NCHS/CDC Reference Median - Gómez Classification			
	3° <60.0	2° 60.0-74.9	1° 75.0-89.9	Normal 90.0+
Marginal Urban	0.4	7.7	46.0	45.9
Intensive Agricultural	1.0	12.0	51.1	35.9
Central Marginal Agricultural	0.6	12.5	54.1	32.8
Northern Marginal Agricultural	1.4	15.8	53.7	29.1
Average	0.9	12.1	51.2	35.8

VIa. Percentage Distribution of January-March 1978 Survey Population by the Weight-for-Age Index (Gómez Classification) by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median - Gómez Classification			
	3° <60.0	2° 60.0-74.9	1° 75.0-89.9	Normal 90.0+
6-11	0.7	7.3	37.6	54.4
12-23	0.7	11.8	48.4	39.1
24-35	1.0	9.5	48.0	41.5
36-47	0.4	9.7	51.8	38.1
48-59	0.6	9.8	55.3	34.3
Average	0.7	9.9	49.3	40.1

VIb. Percentage Distribution of July-September 1978 Survey Population by the Weight-for-Age Index (Gómez Classification) by Age Group

Age (Months)	Percent of NCHS/CDC Reference Median - Gómez Classification			
	3° <60.0	2° 60.0-74.9	1° 75.0-89.9	Normal 90.0+
6-11	1.8	9.3	42.9	46.0
12-23	1.7	14.4	49.3	34.6
24-35	0.5	11.4	47.9	40.2
36-47	0.5	11.7	55.4	32.4
48-59	0.3	12.1	57.3	30.3
Average	0.9	12.1	51.2	35.8

VIIa. Distribution of Preschoolchildren by Arm Circumference Values and by Region

El Salvador: January-March, 1978

n Circumference Values	Regions: Urban		Intensive Agricultural		Central Marginal Agricultural		Northern Marginal Agricultural		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
12.0	10	1.0	10	1.1	7	0.9	8	0.8	35	1.0
12.5	18	1.8	37	4.1	18	2.3	25	2.4	98	2.6
2.5-12.9	13	1.3	28	3.1	19	2.5	29	2.8	89	2.4
3.0-13.9	97	9.8	129	14.4	96	12.4	177	16.9	499	13.5
14.0 +	861	87.1	702	78.3	640	82.8	816	77.9	3,019	81.5
otal	989	100.0	896	100.0	773	100.0	1,047	100.0	3,705	100.0

VIIb. Distribution of Preschoolchildren by Arm Circumference Values and by Region

El Salvador: July-September, 1978

n Circumference Values	Regions: Urban		Intensive Agricultural		Central Marginal Agricultural		Northern Marginal Agricultural		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
12.0	7	0.7	14	1.6	17	2.2	22	2.1	60	1.6
12.5	16	1.7	31	3.5	26	3.3	49	4.7	122	3.3
2.5-12.9	16	1.7	37	4.1	28	3.6	44	4.2	125	3.4
3.0-13.9	74	7.7	127	14.1	106	13.7	168	16.1	475	12.9
14.0 +	851	88.9	704	78.3	617	79.4	783	75.0	2,955	80.4
otal	957	100.0	899	100.0	777	100.0	1,044	100.0	3,677	100.0

Appendix E - El Salvador Nutrition Status Survey Form

Localidad _____

ENCUESTA DE NUTRICION EN EL SALVADOR

REGION	No. DEL SITIO DE MUESTRA	EQUIPO No.	FECHA DE ENTREVISTA Día	Mes	Año
(1)	(2 - 4)	(5)	(6 - 7)	(8 - 9)	(10-11)

NIÑO No.	SEXO 1=M; 2=F	EDAD Años-Meses		FUENTE 1=Oficial 2=Familiar 9=Otro	PESO (Kgs)		ALTURA (Cms)		CIRCUNFERENCIA DEL BRAZO (Cms)		Página No. 1 Diarrea 1-No 2-Si/Clin. 3-Si/No Clin. 9-No se Sabe.
(12-13)	(14)	(15)	(16-17)	(18)	(19-20)	(21)	(22 - 24)	(25)	(26-27)	(28)	(29)

Localidad

ENCUESTA DE NUTRICION EN EL SALVADOR

Página No. 2

NIÑO No. (12-13)	1=Embarazo - 1er.trimestre 2=Embarazo - 2° trimestre 3=Embarazo - 3er.trimestre 4=Alimentación Pecho 5=Ninguno 8=Madre Ausente 9=Desconocido (30)	Sangre colectada del Niño 1=SI 2=NO (31)	Hb del Niño (32-33) (34)	Sangre colectada de la Madre 1=SI 2=NO (35)	Hb de la Madre (36-37) (38)	Tensión del Pelo (39-40)