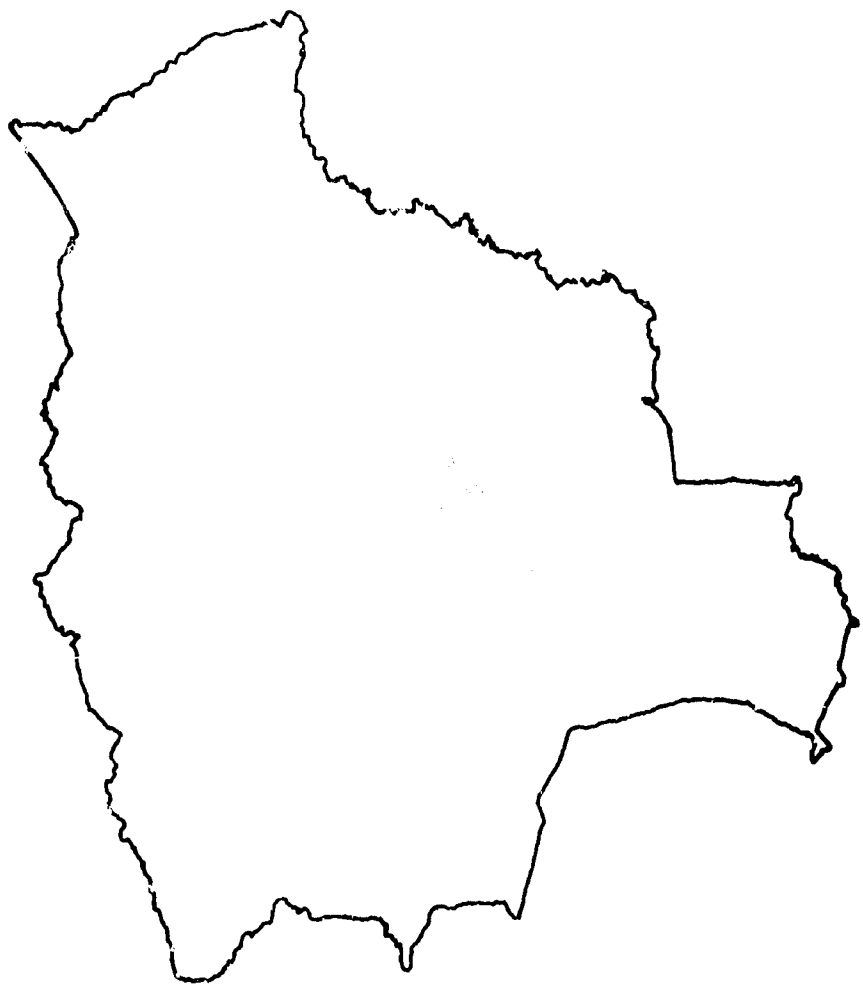
PN-ABB-876

# Bolivia National Nutritional Status Survey

## 1981

## SUMMARY REPORT



Office of Nutrition
Bureau for Science and Technology
Agency for International Development
Washington, D.C. 20523

# SUMMARY REPORT

# OF THE

# BOLIVIA

# NUTRITION STATUS SURVEY

# 1981

Conducted by

The National Institute
of Food and Nutrition
Ministry of Planning and Coordination
Government of Bolivia

in cooperation with the
United States Agency for International Development

with the assistance of the

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

and the
International Center for Epidemiologic and Preventive Ophthalmology
The Johns Hopkins University

## ACKNOWLEDGMENT

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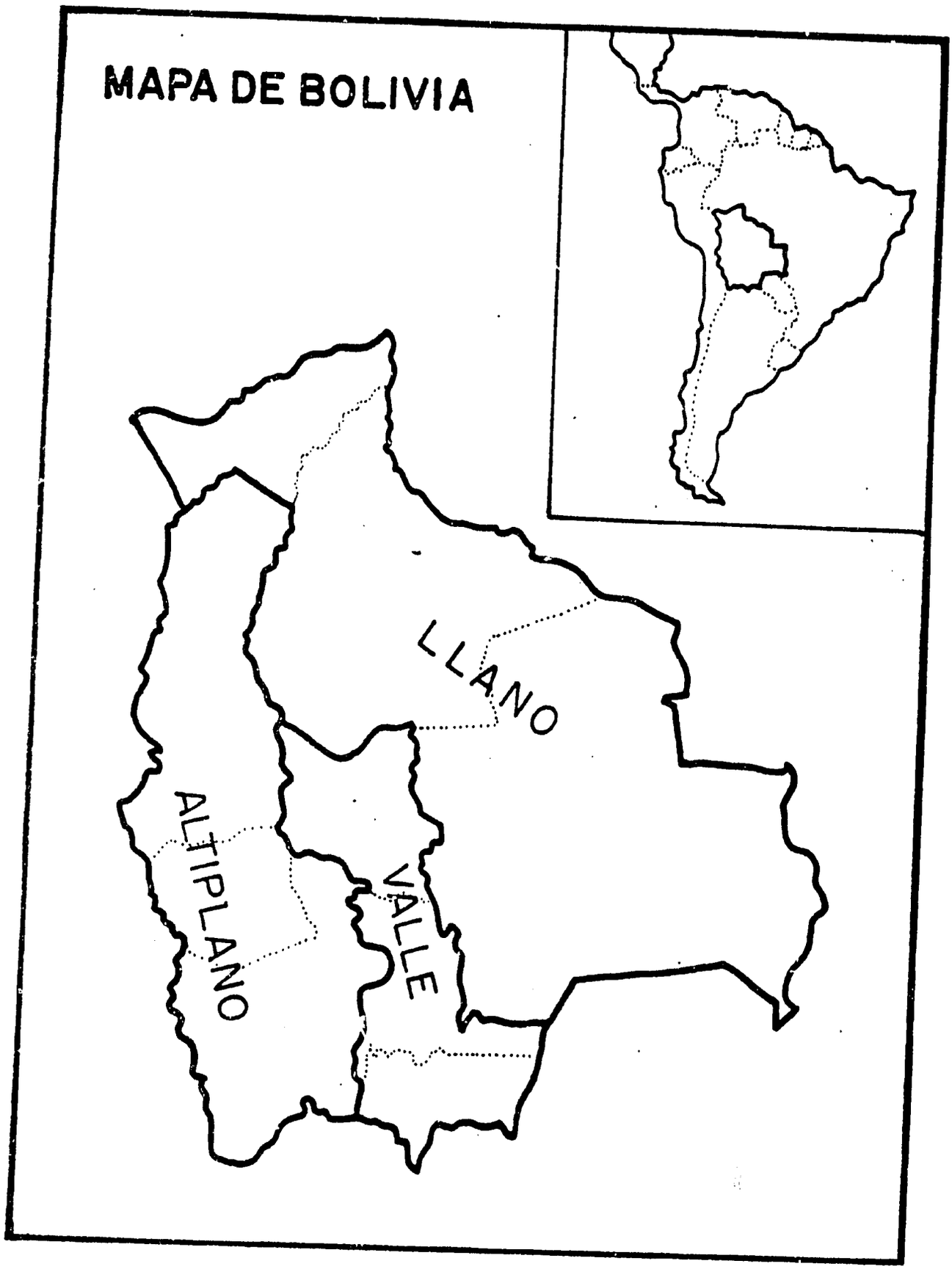
MAPA DE BOLIVIA
LLANO
ALTIPLANO
VALLE

## Highlights

The Bolivia National Institute of Food and Nutrition assisted by the Centers for Disease Control (CDC), in cooperation with United States agency for International Development (USAID), conducted a country-wide survey of growth status of preschool children ages 6 to 59 months. Conducted during June and July of 1981, the survey collected data on the prevalence of protein-energy malnutrition.

Through population proportionate sampling, a total of 105 rural and small village survey sites were selected in the three major geographical areas of the country. However, the 90 sites in the three large urban universes were selected from low-income areas and population proportionate sampling of the entire urban areas was not used. The survey obtained nutritional status data on 5,880 children.

The prevalence of chronic undernutrition, as evidenced by height-for-age more than 2 standard deviations below the reference-population mean (see Figure 1), ranged from 26.6% to 56.4% throughout the country. The expected percentage of children more than 2 standard deviations below the U.S. reference population mean who would exhibit this condition is 2.3%. Thus, in rural areas about 278,000 children are chronically undernourished; in the urban areas about 75,000 children are chronically undernourished. The urban estimate represents the entire urban universes and may be somewhat inflated since the sampling was done only in the low-income strata. Low height-for-age was most prevalent in

the rural, high-plains area (Altiplano) of the country (56.4% of the children surveyed live in this area). See Figures 2 and 3.

Acute undernutrition, defined as weight-for-height more than 2 standard deviations below the U.S. reference-population mean, was not found to be a major problem. The prevalence of acute undernutrition ranged from 0.0% to 1.4% among the children surveyed. Therefore, severe acute protein-energy malnutrition was not a prevalent problem. Overweight children were seen most often in the urban plains (Llano) city of Santa Cruz (5.5%), least often in the rural high-plains (1.0%).

Vitamin A deficiency signs were found to be low in all areas. Night blindness (a result of vitamin A deficiency) was most prevalent in the plains area (2.4% in the rural area and 1.9% in the urban plains area of Santa Cruz).

Chronic undernutrition therefore appears to be the greatest concern, especially in the rural high-plains where qualitative and quantitative nutritional deficiencies prevail and where food production is less than ideal because of the high altitude.

# BOLIVIA NUTRITION STATUS SURVEY, 1981

## INTRODUCTION

The National Institute of Food and Nutrition, Government of Bolivia Ministry of Planning and Coordination, conducted a nutritional-status survey during June and July 1981. The Centers for Disease Control, Center for Health Promotion and Education, Division of Nutrition, Atlanta, Georgia assisted in planning the survey, training the survey workers, and analyzing the results. The Johns Hopkins University, Baltimore, Maryland, assisted in training survey workers for the vitamin A deficiency component.

The Government of Bolivia recognized a pressing need to gather information on the nutritional status of preschool children in order to better plan food and nutrition policies for the country. Various small studies done at different times in the country indicated serious problems of protein-energy malnutrition and vitamin A deficiency.

Therefore, a nation-wide survey of the three major geographical areas was conducted, utilizing the classification scheme proposed by Waterlow and Rutishauser in 1974 for the measurements and analysis of malnutrition.[1]

## OBJECTIVES

### General Objectives

1. Determine the prevalence of childhood protein-energy malnutrition and vitamin A deficiency in Bolivia.

2. Provide information that will be useful in developing policies for food and nutrition programs at the national and regional levels.

3. Identify priority areas for future studies related to food and nutrition.

Specific Objectives

Provide statistically valid data about the prevalence of protein-energy malnutrition among children 6 to 59 months of age by:

1. Geographic areas:

   Altiplano - (High-Plains) approximately 3,000-4,000 meters above sea level

   Valles - (Valleys) approximately 1,800-2,500 meters above sea level

   Llanos - (Plains) approximately 100-800 meters above sea level

2. Rural and urban areas: to identify geographic areas where children are at greatest risk.

3. Age groups: to identify children at greater risk for undernutrition.

4. Demographic and socioeconomic factors: to evaluate the relationships between those factors and undernutrition.

5. Breastfeeding status: to compare the prevalence of undernutrition among those children that do and those that do not receive breast milk.

6. Morbidity status : to evaluate the association between nutritional status and recent illness (by age group).

## GENERAL CHARACTERISTICS OF BOLIVIA

Bolivia is bordered by Brazil, Paraguay, Argentina, Peru and Chile. It covers an area of 1,098,581 square kilometers and has 5,755,072 inhabitants; its population density is 5.94 persons per square kilometer.

Fifty percent of the population live in "dispersed areas" or communities of 200 inhabitants or less; while 7% live in concentrated rural communities of 200-2,000 persons; 43% live in population centers of more than 2,000 persons. Three languages are spoken: Spanish, Quechua and Aymara, (the latter two are Indian languages). Thirty-three percent of the population speak only Spanish; 19% speak only Quechua or Aymara; 37% speak Spanish and one of the Indian languages.

The birth rate is 43 per 1,000 live births, while infant mortality is 130 per 1,000 live births.

## METHODS

### Sampling

A total of 6 sampling universes were chosen for the survey. Each of the three major geographical areas had an urban and a rural universe. Each urban universe had 30 clusters of 30 children each, while the rural universes each had 35 clusters of 30 children each. Because the population is so widely dispersed in the rural areas, 35 clusters were chosen in order to make the samples as representative as possible. A total of 25 clusters were selected for the concentrated rural communities, while 10 were selected for communities of fewer than 200 people.

The survey teams randomly selected the first household within each cluster from a list of households and located this household on a map. The next house was selected by proceeding to the right when leaving the first. This process continued until 30 children between 6 and 59 months of age had been identified and examined in each cluster, and a total of 5,880 children had been surveyed.

The capital city of each department in the three major geographic areas was selected for the urban samples: for the high-plains, the city of La Paz; for the valley, the city of Cochabamba; and for the plains, the city of Santa Cruz. Only low-income populations living in marginal conditions were sampled in the urban areas in order to orient the samples toward that high-risk population. The low-income houses were defined according to classification of the type of structure. For a listing of each universe, and the corresponding population, see Table 1.

## LOGISTICS

Once the localities, clusters, and times for the survey were determined, the Ministries of the Interior and of Education asked local authorities to help motivate the communities to participate in the surveys.

There were 12 survey teams, with a supervisor and physician for each 2 teams. Each team consisted of two trained surveyors; most of the surveyors had previous public-health experience. Each two teams shared a vehicle and driver.

Maps of each locality and cluster had been prepared before the survey began and, in most cases had been verified.

Each member of the survey team had attended a 3-week training course in which the purpose, methods, and techniques for collecting data were covered in great detail. The importance of accurate and reproducible anthropometric measurements was emphasized.

The survey teams used a portable CDC measuring board to determine the height of an older child (in the vertical position) or the length of an infant (in the horizontal position). Heights were measured to the nearest tenth of a centimeter and weight was determined to the nearest tenth of a kilogram by using a Salter hanging scale.

Each child was given an eye examination, in order to detect clinical evidence of vitamin A deficiency. The feet of each child were examined for signs of pedal edema.

No blood determinations were made during this survey.

## ANTHROPOMETRIC INDICES

Three anthropometric indices are used to describe the nature and extent of malnutrition in preschool children: weight-for-height, height-for-age, and weight-for-age.[2,3] Weight-for-height, an estimate of body proportions, provides a measure of current acute nutritional status in regard to both undernutrition and overnutrition. Height-for-age, a measure of growth retardation is an indicator of past or chronic undernutrition. The weight-for-age index is a measure of the combined current and past components of overnutrition and undernutrition[4] and does not discriminate between the acutely undernourished or thin child and the chronically undernourished child who exhibits linear growth retardation.[1]

Data for all anthropometric indices presented are relative to the NCHS/CDC reference median.[5] This reference is comparable to and replaces the commonly used Stuart-Meredith reference for weight and height.[6] However, the larger number of children, improved sampling techniques, direct weight-for-height calculations, and the complete statistical description used in the NCHS/CDC reference data permit improved statistical precision in describing anthropometric data.

## DIFFERENT CLASSIFICATION SCHEMES

The anthropometric data have been classified according to three different types of criteria; percentiles, standard deviations and the cross-classification proposed by Waterlow and Rutishauser.[1] Utilizing the percentile classification, children whose weight-for-height values fall below the fifth percentile of the reference population are considered at risk. Children whose weight-for-height values are greater than the 95th percentile

are considered overweight. Children whose height-for-age values fall below the fifth percentile of the reference population are considered at risk.

Data analysis was also done by using cutoff values based on standard deviations. Values more than 2 standard deviations below the reference mean (-2SD) have been defined as indicative of undernutrition for each of the 3 anthropometric indices. See Figure 1.

Waterlow and Rutishauser proposed a system of classification that permits the combined assessment of stunting and wasting in children by cross-classifying the two indices, 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.[1] In the nomenclature of this report, "stunted" is measured by low height-for-age, and "wasted" by low weight-for-height. Each of these four categories has different health implications. For this cross-classification scheme, 2 standard deviations below the mean has been used as the cutoff point for each index. An example of this classification system as used in the Bolivian study may be seen in Table 2.

## ACUTE UNDERNUTRITION

Table 2 presents the distribution of children according to the Waterlow classification by geographic areas. The weight and height ranges are classified by standard deviation from the reference population mean. Those children whose weight-for-height, height-for-age, or both were grouped at more than 2 standard deviations below the mean are considered at nutritional risk.

The highest percentage of low weight-for-height values in any urban area sampled was only 0.7%; for rural areas, it was 1.2%. Both the urban and the rural areas with the highest percentage of low weight-for-height values are located in the plains. The combined classification of chronic and acute undernutrition were correspondingly low with the highest deficit being 0.6% in the urban area of th lleys.

Table 3 presents the measurements of weight-for-height by range of percentiles of the reference median. The highest percentage of low weight-for-height (when defined as less than the fifth percentile) was 3.0% (urban-valley universe). Obesity (defined as weight-for-height values above the 95th percentile) was most prevalent (11.1%) in the urban plains universe of Santa Cruz.

Table 4 presents the perc ntage distribution of children by geographic area and weight-for-height. The percentage distribution is based on the extent to which weight-for-height values vary as measured by standard deviations, from the mean. Again it can be seen that a very small proportion of the population falls more than 2 standard deviations below the mean. High weight-for-height values (more than 2 standard deviations above the mean) were most prevalent (5.5%) in the urban plains area (Santa Cruz).

## GROWTH RETARDATION

The height-for-age distribution is shown in table 5. The prevalence of chronic undernutrition ranged from 34.5% to 66.5% in the six geographic areas surveyed when defined as the percentage of children whose height-for-age values fall below the fifth percentile of the NCHS/CDC reference population

mean. Chronic undernutrition was slightly more prevalent in rural than in urban areas, and was most prevalent in the high-plains/rural area (Figures 2 and 3).

Table 6 shows the same information, but distributed on the basis of standard deviations from the mean. The distribution of low height-for-age values is also shown in Table 2, (the Waterlow classification). Again there is a high percentage of low height-for-age values in all areas demonstrating apparent chronic undernutition. In the most critical or highest risk category, (combined wasting and stunting), 0.6% was the highest figure reported in any of the six survey areas. Therefore, the prevalences of wasting only and stunting only generally approximate the prevalences for acute undernutrition and for chronic undernutrition respectively.

## FEEDING PATTERNS

Breastfeeding patterns by age of child and geographic area are shown in Table 7. The prevalence of breastfeeding for infants 6-11 months of age ranged from 44% to 96%. The urban plains area of Santa Cruz had the lowest prevalence (44%). For children 6-35 months of age, the urban and rural high-plains areas had the highest overall prevalences of breastfeeding. There is a sharp drop-off in the breastfeeding of infants 12-23 months of age in all but the high-plains areas. For all areas, the prevalence of breastfeeding for infants 24-35 months of age drops even lower.

## MORBIDITY

The relationship between weight-for-height and recent episodes of diarrhea, fever, and other illnesses is shown in table 8. The data are presented according to standard deviations from the reference population mean. An increased frequency of diarrhea was associated with low weight-for-height values. In other words, the lower the weght-for-height of the child the more frequent the reported recent episodes of diarrhea. The same relationship held true for fever, but was not observed for "other illness." The relationship was also found between frequency of diarrhea and low height-for-age values, but to a lesser degree. Tables 9A and 9B present prevalences of morbidity by age and geographic area.

## VITAMIN A DEFICIENCY

Night blindness, Bitot spots, and corneal scarring are indicative of vitamin A deficiency. The general prevalence of night blindness was 1.1%. Night blindness was found in all areas, but was most prevalent in the plains area (2.4% in the rural and 1.9% in the urban plains area of Santa Cruz). Bitot spots were found in five children, all females 35-59 months of age. Eight children (4 male and 4 female) had corneal scarring.

## DISCUSSION

During 1981, the Bolivian National Institute of Food and Nutrition carried out a study to determine the nutritional status of children between 6 and 59 months of age in all regions of the country.

Objectives of the study consisted of obtaining information about the nutritional status of those children along with information about breastfeeding, mortality, morbidity, natality, and vitamin A deficiency. Also relationships between nutritional status and these variables were studied.

It would have been ideal if the investigation could have offered representative data by administrative divisions (departments). However, two factors prevented this: (1) there were limited financial resources for the study; and (2) it was important to describe the different nutritional phenomena by geographic and ecologic zones and urban and rural areas because of the different characteristics of those areas.

Analysis of the final results of the study corroborated the validity of this approach. The aggregate data were representative of Bolivia's population and would not have been much different even if sampling had been conducted at the departmental level. Of the 5,880 children surveyed, 2,743 lived in an urban area and 3,137 in a rural area. (Of these 3,137 children, 2,268 lived in a concentrated rural area and 869 lived in a "dispersed" area.

The greatest nutritional problem among the children surveyed was linear growth retardation (defined as more than two standard deviations from the expected

height-for-age) which reflects chronic undernutrition and implies persistent and/or recurring shortages of calories and/or other nutrients. The prevalence of chronic undernutrition ranged from 26.6% to 45.8% in the urban areas and from 35.1% to 56.4% in the rural areas. On the other hand, the general prevalence of acute undernutrition was very low ranging from 0.0% to 1.4%.

Although a cross-sectional survey like this one cannot adequately explain the causes of high prevalence of chronic undernutrition, remedial actions to address likely factors such as inadequate diets and high exposure to infectious diseases should be taken. In regard to interpreting the low prevalence of acute undernutrition one hypothesis is that the condition appears and disappears in relation to the cyclical periods of agricultural production. Data for this study were collected during June and July, a short time after the completion of important crop production for the different areas and a time when acute undernutrition may have been at relatively low prevalence.

In the rural areas, where most of the people live, almost 50% of the children less than 5 years of age suffer from chronic undernutrition, and most of these children never recoup their normal expected height. Approximately 75,000 children in the urban areas suffer from chronic undernutrition. Because the urban samples were drawn only from low-income areas, this estimate may be somewhat inflated.

Nutrition-related problems were more prevalent in rural than in urban areas. A clear pattern of nutritional status was also observed which differentiated the three geographic regions. Nutrition-related problems were most prevalent in the high-plains area, possibly because of precarious socioeconomic conditions experienced by both urban and rural populations.

Chronic undernutrition is greater in the rural areas and increases with age in both the urban and rural areas (Figure 2 and 3).

Chronic undernutrition was most prevalent among children of low-income families, families with illiterate parents, and families that use the open field for elimination of excreta. The child mortality rate was higher for families with children of short stature than for families with children of normal stature.

A high percentage of mothers reported breastfeeding infants through the ages of 6 to 11 months, except in the city of Santa Cruz, where prevalence of breastfeeding was lower. In general, the prevalence of breastfeeding was higher among mothers of the high-plains area than among mothers in other regions, and also higher among mothers residing in rural areas than in urban areas.

Even though there was no significant correlation between duration of breastfeeding and age of the mother, young mothers (15-19 years of age) were more likely to stop breastfeeding after 12 months. The prevalence of breastfeeding among families in which the parents were illiterate was higher than among families in which the parents were literate.

One finding that stands out in relation to morbidity was the high prevalence of diarrhea, especially among children from 6 to 23 months of age, (tables 9A and 9B). Among these children, diarrhea was most prevalent among children from the rural and urban areas of the high-plains, and was next most prevalent among children from the plains and valleys. An inverse relationship was found between the prevalence of reported diarrhea and the anthropmetric indices for both acute and chronic undernutrition.

An inverse relationship was also found between the prevalence of fever and the indices of weight-for-height. The high-plains region, once again, was the most affected.

The percentages of childhood mortality reported were very high in all areas studied, especially among children less than one year old and ranged from 6.5% to 16.5% (see table 10). The percentage for urban and rural areas of the high-plains again were notably higher. Also, families with illiterate parents had higher rates of mortality.

Very few clinical signs of vitamin A deficiency were found. Nevertheless, in the plains, the prevalence of night blindness was 1.8% for males and 2.4% for females, and may reflect vitamin A deficiency; this problem deserves more in depth study.

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Table 1

Population Distribution
by Geographic Areas Surveyed

Bolivia-1981

| Geographic Areas | Universe | Department | Areas | Total Population |
|---|---|---|---|---|
| Urban Area | | | | |
| Altiplano (High-Plains) | 1 | La Paz | City of La Paz | 157,529 * |
| Valle (Valley) | 2 | Cochabamba | City of Cochabamba | 93,454 * |
| Llano (Plains) | 3 | Santa Cruz | City of Santa Cruz | 83,058 * |
| Rural Area | | | | |
| Altiplano (High-Plains) | 4 | La Paz<br>Oruro<br>Potosi | Rural concentrated<br>Rural dispersed | 159,227<br>1,211,234 |
| Valle (Valley) | 5 | Chuquisaca<br>Cochabamba<br>Tarija | Rural concentrated<br>Rural dispersed | 80,305<br>753,975 |
| Llano (Plains) | 6 | Santa Cruz<br>Beni<br>Pando | Rural concentrated<br>Rural dispersed | 79,220<br>364,159 |

*Population estimated by low income strata, classified according to housing characteristics by the Bolivian National Institute of Statistics - 1976 Census.

Table 2

Distribution of Children by Waterlow Classification and by Geographic Area

Bolivia-1981

| Geographic Area | WATERLOW CLASSIFICATION: Low Weight/ Height (Acute Under-nutrition or wasted)* | Low Stature (Chronic Undernutrition or stunted)** | Concurrent Chronic & Acute Undernutrition (wasted & stunted) | Normal not (wasted or stunted) | Children Surveyed |
|---|---|---|---|---|---|
| Urban Area | | | | | |
| High-Plains (La Paz) | 0.1% | 45.6% | 0.2% | 54.1% | (896) |
| Valley (Cochabamba) | 0.6% | 28.0% | 0.6% | 70.9% | (890) |
| Plains (Santa Cruz) | 0.7% | 26.5% | 0.1% | 72.7% | (885) |
| Rural Area | | | | | |
| High-Plains | 0.0% | 56.3% | 0.0% | 43.7% | (1,045) |
| Valley | 1.0% | 46.1% | 0.3% | 52.5% | (1,038) |
| Plains | 1.2% | 35.1% | 0.0% | 63.7% | (1,009) |
| Total Rural | 0.5% | 49.4% | 0.1% | 50.0% | (3,092) |

*Weight-for-height more than 2 standard deviations below the reference population median.

**Height-for-age more than 2 standard deviations below the reference population median.

The percentages have been weighted on the basis of population proportions.

## Table 3

### Distribution of Children Surveyed by the Index Weight-for-Height in Percentiles, by Geographic Area

Bolivia-1981

| Range of Percentiles | Geographic Area: High-Plains Urban (La Paz) % | Accum. | Valley Urban (Cochabamba) % | Accum. | Plains Urban (Santa Cruz) % | Accum. | *Total Urban |
|---|---|---|---|---|---|---|---|
| Below 3.0 | 0.6 | | 1.6 | | 0.9 | | |
| Below 5.0 | 1.2 | | 3.0 | | 1.3 | | |
| Below 10.0 | 3.4 | 3.4 | 6.4 | 6.4 | 3.1 | 3.1 | |
| 10.0 - 19.9 | 5.8 | 9.2 | 7.4 | 13 9 | 3.4 | 6.5 | |
| 20.0 - 29.9 | 7.1 | 16.3 | 7.6 | 21.4 | 5.0 | 11.5 | |
| 30.0 - 39.9 | 8.1 | 24.4 | 10.4 | 31.8 | 7.2 | 18.7 | |
| 40.0 - 49.9 | 11.7 | 36.1 | 11.0 | 42.8 | 7.2 | 25.9 | |
| 50.0 - 59.9 | 12.4 | 48.5 | 13.3 | 56.1 | 11.0 | 36.9 | |
| 60.0 - 69.9 | 13.5 | 62.0 | 13.2 | 69.3 | 11.2 | 48.1 | |
| 70.0 - 79.9 | 13.7 | 75.7 | 11.1 | 80.4 | 14.8 | 62.9 | |
| 80.0 - 89.9 | 13.1 | 88.8 | 10.4 | 90.8 | 14.8 | 77.7 | |
| 90.0 or more | 11.3 | 100.0 | 9.2 | 100.0 | 22.4 | 100.0 | |
| 95.0 or more | 5.0 | | 4.9 | | 11.1 | | |
| 97.0 or more | 2.6 | | 2.6 | | 7.2 | | |
| Total Number | (896) | | (890) | | (885) | | |

| | High-Plains Rural % | Accum. | Valley Rural % | Accum. | Plains Rural % | Accum. | Total Rural % | Accum. |
|---|---|---|---|---|---|---|---|---|
| Below 3.0 | 0.1 | | 1.8 | | 1.6 | | 0.9 | |
| Below 5.0 | 1.1 | | 2.9 | | 2.4 | | 1.9 | |
| Below 10.0 | 5.1 | 5.1 | 5.6 | 5.6 | 4.5 | 4.5 | 5.1 | 5.1 |
| 10.0 - 19.9 | 7.4 | 12.5 | 9.1 | 14.8 | 5.7 | 10.2 | 7.7 | 12.8 |
| 20.0 - 29.9 | 8.8 | 21.3 | 6.6 | 21.4 | 6.5 | 16.7 | 7.7 | 20.5 |
| 30.0 - 39.9 | 8.6 | 29.9 | 9.4 | 30.8 | 7.7 | 24.4 | 8.7 | 29.2 |
| 40.0 - 49.9 | 12.2 | 42.1 | 11.3 | 42.1 | 10.8 | 35.2 | 11.7 | 40.9 |
| 50.0 - 59.9 | 10.8 | 52.9 | 11.2 | 53.3 | 14.7 | 49.9 | 11.6 | 52.5 |
| 60.0 - 69.9 | 11.4 | 64.3 | 13.3 | 66.6 | 11.6 | 61.5 | 12.0 | 64.5 |
| 70.0 - 79.9 | 15.3 | 79.6 | 10.5 | 77.2 | 13.4 | 74.9 | 13.5 | 78.0 |
| 80.0 - 89.9 | 10.6 | 90.0 | 12.8 | 89.9 | 14.5 | 89.3 | 11.9 | 89.9 |
| 90.0 or more | 9.9 | 100.0 | 10.1 | 100.0 | 10.7 | 100.0 | 10.1 | 100.0 |
| 95.0 or more | 4.7 | | 4.1 | | 5.9 | | 4.7 | |
| 97.0 or more | 3.0 | | 3.7 | | 3.3 | | 3.3 | |
| Total Number | (1,045) | | (1,038) | | (1,009) | | (3,092) | |

*No total since samples were not probability samples of entire area. The percentages have been weighted on the basis of population proportions.

Table 4

Distribution of Children by the Index Weight-for-Height
In Standard Deviations by Geographic Area

Bolivia-1981

| Ranges of Standard Deviations | Geographic Area: High-Plains Urban (La Paz) % | High-Plains Urban (La Paz) % Accum. | Valley Urban (Cochabamba) % | Valley Urban (Cochabamba) % Accum. | Plains Urban (Santa Cruz) % | Plains Urban (Santa Cruz) % Accum. | *Total Urban |
|---|---|---|---|---|---|---|---|
| Below -3.50 | - | - | 0.1 | 0.1 | - | - | |
| -3.50 to -3.01 | - | - | - | 0.1 | - | - | |
| -3.00 to -2.51 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | |
| -2.50 to -2.01 | 0.2 | 0.3 | 0.9 | 1.1 | 0.6 | 0.9 | |
| -2.00 to -1.51 | 2.1 | 2.5 | 2.9 | 4.0 | 1.0 | 1.8 | |
| -1.50 to -1.01 | 4.5 | 6.9 | 6.5 | 10.5 | 3.2 | 5.0 | |
| -1.00 to -.51 | 9.7 | 16.7 | 11.3 | 21.8 | 7.2 | 12.2 | |
| -.50 to -.01 | 19.2 | 35.8 | 20.7 | 42.5 | 13.6 | 25.8 | |
| -.00 to .50 | 25.1 | 60.9 | 25.9 | 68.4 | 21.4 | 47.2 | |
| .51 to 1.00 | 20.3 | 81.2 | 17.3 | 85.7 | 21.3 | 68.5 | |
| 1.01 to 1.50 | 12.2 | 93.4 | 7.9 | 93.6 | 17.1 | 85.6 | |
| 1.51 to 2.00 | 4.3 | 97.8 | 4.3 | 98.1 | 8.9 | 94.5 | |
| 2.01 or more | 2.2 | 100.0 | 1.9 | 100.0 | 5.5 | 100.0 | |
| Total Number | (896) | | (890) | | (885) | | |

| Ranges of Standard Deviations | High-Plains Rural % | High-Plains Rural % Accum. | Valley Rural % | Valley Rural % Accum. | Plains Rural % | Plains Rural % Accum. | Total Rural % | Total Rural % Accum. |
|---|---|---|---|---|---|---|---|---|
| Below -3.50 | - | - | - | - | 0.8 | 0.8 | 0.1 | 0.1 |
| -3.50 to -3.01 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.1 |
| -3.00 to -2.51 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 1.2 | 0.1 | 0.2 |
| -2.50 to -2.01 | 0.0 | 0.0 | 1.3 | 1.4 | 0.0 | 1.2 | 0.4 | 0.7 |
| -2.00 to -1.51 | 2.3 | 2.3 | 2.9 | 4.3 | 1.9 | 3.1 | 2.4 | 3.1 |
| -1.50 to -1.01 | 6.8 | 9.1 | 7.5 | 11.7 | 4.5 | 7.7 | 6.6 | 9.7 |
| -1.00 to -.51 | 12.6 | 21.7 | 10.4 | 22.1 | 10.2 | 17.9 | 11.5 | 21.1 |
| -.50 to -.01 | 20.1 | 41.8 | 20.0 | 42.1 | 17.3 | 35.2 | 19.6 | 40.7 |
| .00 to .50 | 21.6 | 63.4 | 23.6 | 65.7 | 25.8 | 61.0 | 23.0 | 63.6 |
| .51 to 1.00 | 20.0 | 83.3 | 17.6 | 83.3 | 20.9 | 81.9 | 19.4 | 83.1 |
| 1.01 to 1.50 | 10.4 | 93.7 | 10.6 | 93.9 | 9.8 | 91.7 | 10.3 | 93.4 |
| 1.51 to 2.00 | 5.3 | 99.0 | 2.4 | 96.3 | 5.1 | 96.8 | 4.4 | 97.8 |
| 2.01 or more | 1.0 | 100.0 | 3.7 | 100.0 | 3.2 | 100.0 | 2.2 | 100.0 |
| Total Number | (1,045) | | (1,038) | | (1,009) | | (3,092) | |

*No total since samples were not probability samples of entire area.

The percentages have been weighted on the basis of population proportions

Table 5

**Distribution of Children Surveyed by the Index Height-for-Age in Percentiles, by Geographic Area**

Bolivia-1981

| Range of Percentiles | Geographic Area: High-Plains Urban (La Paz) % | Accum. | Valley Urban (Cochabamba) % | Accum. | Plains Urban (Santa Cruz) % | Accum. | *Total Urban |
|---|---|---|---|---|---|---|---|
| Below 3.0 | 49.6 | | 33.3 | | 28.4 | | |
| Below 5.0 | 60.2 | | 40.8 | | 34.5 | | |
| Below 10.0 | 73.1 | 73.1 | 54.1 | 54.1 | 45.2 | 45.2 | |
| 10.0 - 19.9 | 10.8 | 83.9 | 13.2 | 67.3 | 16.4 | 61.6 | |
| 20.0 - 29.9 | 6.2 | 90.1 | 9.5 | 76.8 | 7.9 | 69.5 | |
| 30.0 - 39.9 | 3.1 | 93.2 | 7.0 | 83.8 | 6.5 | 76.0 | |
| 40.0 - 49.9 | 1.5 | 94.7 | 5.9 | 89.7 | 5.9 | 81.9 | |
| 50.0 - 59.9 | 1.4 | 96.1 | 3.4 | 93.1 | 6.0 | 87.9 | |
| 60.0 - 69.9 | 0.9 | 97.0 | 2.4 | 95.5 | 3.1 | 91.0 | |
| 70.0 - 79.9 | 1.2 | 98.2 | 2.2 | 97.7 | 2.6 | 93.5 | |
| 80.0 - 89.9 | 0.7 | 98.9 | 0.9 | 98.6 | 2.4 | 96.0 | |
| 90.0 or more | 0.9 | 100.0 | 1.4 | 100.0 | 4.0 | 100.0 | |
| 95.0 or more | 0.7 | | 1.2 | | 2.9 | | |
| 97.0 or more | 0.5 | | 1.1 | | 2.1 | | |
| Total Number | (896) | | (890) | | (885) | | |

| | High-Plains Rural % | Accum. | Valley Rural % | Accum. | Plains Rural % | Accum. | Total Rural % | Accum. |
|---|---|---|---|---|---|---|---|---|
| Below 3.0 | 61.6 | | 51.7 | | 37.5 | | 54.3 | |
| Below 5.0 | 66.5 | | 62.6 | | 41.0 | | 60.9 | |
| Below 10.0 | 79.3 | 79.3 | 70.9 | 70.9 | 50.4 | 50.4 | 71.7 | 71.7 |
| 10.0 - 19.9 | 9.7 | 88.9 | 7.9 | 78.9 | 13.3 | 63.7 | 9.7 | 81.4 |
| 20.0 - 29.9 | 5.5 | 94.4 | 5.6 | 84.5 | 11.1 | 74.8 | 6.5 | 87.9 |
| 30.0 - 39.9 | 1.4 | 95.8 | 4.0 | 88.5 | 5.1 | 79.9 | 2.8 | 90.7 |
| 40.0 - 49.9 | 1.1 | 96.9 | 3.1 | 91.5 | 6.0 | 86.0 | 2.6 | 93.3 |
| 50.0 - 59.9 | 0.9 | 97.8 | 2.3 | 93.8 | 3.8 | 89.8 | 1.8 | 95.1 |
| 60.0 - 69.9 | 0.4 | 98.2 | 1.5 | 95.4 | 2.7 | 92.4 | 1.2 | 96.3 |
| 70.0 - 79.9 | 0.7 | 98.9 | 2.7 | 98.0 | 0.8 | 93.3 | 1.3 | 97.6 |
| 80.0 - 89.9 | 0.7 | 99.6 | 0.0 | 98.1 | 1.5 | 94.8 | 0.7 | 98.3 |
| 90.0 or more | 0.4 | 100.0 | 1.9 | 100.0 | 5.2 | 100.0 | 1.7 | 100.0 |
| 95.0 or more | 0.3 | | 1.6 | | 3.9 | | 1.4 | |
| 97.0 or more | 0.3 | | 1.6 | | 2.2 | | 1.1 | |
| Total Number | (1,045) | | (1,038) | | (1,009) | | (3,092) | |

*No total since samples were not probability samples of entire area.

The percentages have been weighted on the basis of population proportions.

## Table 6

### Distribution of Children Surveyed by the Index Height-for-Age in Standard Deviations, by Geographic Area

Bolivia-1981

| Range of Standard Deviations | Geographic Area: High-Plains Urban (La Paz) % | High-Plains Urban (La Paz) % Accum. | Valley Urban (Cochabamba) % | Valley Urban (Cochabamba) % Accum. | Plains Urban (Santa Cruz) % | Plains Urban (Santa Cruz) % Accum. | *Total Urban |
|---|---|---|---|---|---|---|---|
| Less than -3.50 | 5.1 | 5.1 | 5.1 | 5.1 | 4.1 | 4.1 | |
| -3.50 to -3.01 | 8.1 | 13.2 | 5.3 | 10.4 | 3.9 | 8.0 | |
| -3.00 to -2.51 | 14.0 | 27.3 | 7.2 | 17.6 | 7.7 | 15.6 | |
| -2.50 to -2.01 | 18.6 | 45.8 | 11.0 | 28.6 | 11.0 | 26.6 | |
| -2.00 to -1.51 | 19.9 | 65.7 | 17.7 | 46.3 | 11.6 | 38.2 | |
| -1.50 to -1.01 | 13.7 | 79.5 | 16.7 | 63.0 | 17.1 | 55.3 | |
| -1.00 to -.51 | 10.7 | 90.1 | 14.8 | 77.8 | 14.5 | 69.9 | |
| -.50 to -.01 | 4.6 | 94.7 | 12.0 | 89.8 | 12.0 | 81.8 | |
| -.00 to .50 | 2.4 | 97.1 | 5.6 | 95.4 | 8.9 | 90.8 | |
| .51 to 1.00 | 1.3 | 98.4 | 2.8 | 98.2 | 4.2 | 95.0 | |
| 1.01 to 1.50 | 0.7 | 99.2 | 0.7 | 98.9 | 1.4 | 96.4 | |
| 1.51 to 2.00 | 0.4 | 99.5 | 0.1 | 99.0 | 1.8 | 98.2 | |
| 2.01 or more | 0.5 | 100.0 | 1.1 | 100.0 | 1.8 | 100.0 | |
| Total Number | (896) | | (890) | | (885) | | |

| Range of Standard Deviations | High-Plains Rural % | High-Plains Rural % Accum. | Valley Rural % | Valley Rural % Accum. | Plains Rural % | Plains Rural % Accum. | Total Rural % | Total Rural % Accum. |
|---|---|---|---|---|---|---|---|---|
| Less than -3.50 | 15.1 | 15.1 | 6.7 | 6.7 | 10.9 | 10.9 | 11.7 | 11.7 |
| -3.50 to -3.01 | 10.1 | 25.2 | 6.2 | 12.9 | 2.9 | 13.8 | 7.7 | 19.4 |
| -3.00 to -2.51 | 15.5 | 40.8 | 14.2 | 27.1 | 6.5 | 20.3 | 13.6 | 33.0 |
| -2.50 to -2.01 | 15.5 | 56.4 | 19.3 | 46.4 | 14.8 | 35.1 | 16.6 | 49.6 |
| -2.00 to -1.51 | 15.4 | 71.8 | 19.8 | 66.2 | 10.6 | 45.7 | 16.0 | 65.6 |
| -1.50 to -1.01 | 16.1 | 88.0 | 10.9 | 77.1 | 12.7 | 58.4 | 13.9 | 79.5 |
| -1.00 to -.51 | 6.6 | 94.6 | 7.4 | 84.5 | 16.9 | 75.3 | 8.6 | 88.1 |
| -.50 to -.01 | 2.4 | 96.0 | 6.7 | 91.2 | 10.7 | 86.0 | 5.2 | 93.3 |
| .00 to .50 | 1.3 | 98.3 | 3.9 | 95.1 | 5.5 | 91.5 | 2.9 | 96.2 |
| .51 to 1.00 | 1.4 | 99.7 | 3.0 | 98.1 | 2.6 | 94.1 | 2.1 | 98.2 |
| 1.01 to 1.50 | 0.0 | 99.7 | 0.4 | 98.5 | 1.2 | 95.3 | 0.4 | 98.6 |
| 1.51 to 2.00 | 0.0 | 99.7 | 0.3 | 98.8 | 3.1 | 98.4 | 0.6 | 99.2 |
| 2.01 or more | 0.3 | 100.0 | 1.3 | 100.0 | 1.6 | 100.0 | 0.9 | 100.0 |
| Total Number | (1,045) | | (1,038) | | (1,009) | | (3,093) | |

*No total since samples were not probability samples of entire area.

The percentages have been weighted on the basis of population proportion.

## Table 7

### Distribution of Children Breastfeeding, by Age Group, and Geographic Area

### Bolivia-1981

| Geographic Area | Age of Child 6-11 Months | 12-23 Months | 24-35 Months | Total |
|---|---|---|---|---|
| Urban Area | | | | |
| High-Plains (La Paz) | 85% (104)* | 63% (203) | 6% (185) | 46% (492) |
| Valley (Cochabamba) | 82% (101) | 23% (195) | 0% (161) | 28% (457) |
| Plains (Santa Cruz) | 44% (107) | 24% (231) | 1% (168) | 20% (506) |
| **Total Urban | | | | |
| Rural Area | | | | |
| High-Plains | 96% (137) | 70% (233) | 9% (207) | 58% (577) |
| Valley | 86% (125) | 39% (203) | 5% (170) | 36% (498) |
| Plains | 84% (123) | 39% (215) | 4% (220) | 37% (558) |
| Total Rural | 91% (385) | 55% (651) | 7% (597) | 48% (1,633) |

*The numbers in parenthesis refer to the total number of children surveyed.
**No total since samples were not probability samples of entire area.
The percentages have been weighted on the basis of population proportions.

**TABLE 8**

**Distribution of Children with Recent Symptoms of Diarrhea, Fever, or "Other Illnesses" by Weight-for-Height Group (Defined by Standard Deviation Units) in Rural Areas**

**Bolivia-1981**

| | Weight-for-Height Group Standard Deviation Units | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | -1.00 | -1.00 - .51 | - .50 0.0 | 0.0 .50 | .51 1.00 | 1.01 1.50 | 1.51 2.00 | 2.01 | Z Total |
| Diarrhea | 31Z (260)* | 21Z (327) | 18Z (560) | 14Z (777) | 14Z (615) | 13Z (330) | 13Z (126) | 15Z ( 89) | 17Z (3,084) |
| Fever | 28Z (258) | 28Z (327) | 17Z (558) | 16Z (774) | 12Z (611) | 12Z (329) | 18Z (126) | 16Z ( 88) | 18Z (3,071) |
| Other Illnesses | 21Z (260) | 23Z (326) | 13Z (561) | 15Z (776) | 11Z (612) | 13Z (328) | 5Z (126) | 22Z ( 89) | 15Z (3,078) |

*The numbers in parenthesis refer to the number of subjects responding.

The percentages have been weighted on the basis of population proportions

## Table 9A

### Prevalence of Diarrhea, Fever and "Other Illnesses" (As Reported by Childs Parent for Prior Week) by Age of Child and Geographic Area

Bolivia-1961

| Age in Months | Urban Area | | |
|---|---|---|---|
| | High-Plains (La Paz) | Valley (Cochabamba) | Plains (Santa Cruz) |
| | **Prevalence of Diarrhea** | | |
| | % (n) | % (n) | % (n) |
| 6-11 | 26 (109) | 25 (110) | 23 (110) |
| 12-23 | 37 (222) | 17 (226) | 20 (237) |
| 24-35 | 23 (206) | 6 (194) | 11 (175) |
| 36-47 | 20 (202) | 7 (179) | 10 (175) |
| 48-59 | 11 (156) | 3 (174) | 7 (186) |
| TOTAL | 24 (895) | 11 (883) | 14 (883) |
| | **Prevalence of Fever** | | |
| | % (n) | % (n) | % (n) |
| 6-11 | 36 (106) | 20 (111) | 12 (108) |
| 12-23 | 35 (219) | 10 (224) | 16 (235) |
| 24-35 | 22 (205) | 7 (196) | 13 (172) |
| 36-47 | 20 (200) | 9 (181) | 8 (168) |
| 48-59 | 17 (154) | 4 (173) | 9 (184) |
| Total | 26 (884) | 9 (885) | 12 (867) |
| | **Prevalence of "Other Illnesses"** | | |
| | % (n) | % (n) | % (n) |
| 6-11 | 18 (105) | 32 (108) | 25 (109) |
| 12-23 | 23 (216) | 20 (223) | 22 (238) |
| 24-35 | 11 (202) | 19 (196) | 25 (175) |
| 36-47 | 11 (200) | 14 (176) | 19 (175) |
| 48-59 | 11 (155) | 10 (173) | 18 (186) |
| Total | 15 (878) | 18 (876) | 22 (883) |

The percentages have been weighted on the basis of population proportions

Table 9B

Prevalence of Diarrhea, Fever and "Other Illnesses"
(As Reported by Childs Parent for Prior Week)
by Age of Child and Geographic Area

Bolivia-1981

| Age in Months | Rural Area | | | |
|---|---|---|---|---|
| | High-Plains | Valley | Plains | Total |
| | **Prevalence of Diarrhea** | | | |
| | % (n) | % (n) | % (n) | % (n) |
| 6-11 | 25 (145) | 10 (134) | 17 (125) | 20 (404) |
| 12-23 | 41 (262) | 16 (239) | 11 (226) | 29 (727) |
| 24-35 | 20 (248) | 6 (216) | 14 (231) | 14 (695) |
| 36-47 | 24 (180) | 2 (224) | 11 (197) | 14 (601) |
| 48-59 | 7 (208) | 7 (222) | 11 (227) | 8 (657) |
| Total | 24 (1,043) | 8 (1,035) | 12 (1,006) | 17 (3,084) |
| | **Prevalence of Fever** | | | |
| | % (n) | % (n) | % (n) | % (n) |
| 6-11 | 24 (144) | 18 (134) | 10 (124) | 21 (402) |
| 12-23 | 35 (261) | 10 (235) | 24 (227) | 26 (723) |
| 24-35 | 19 (246) | 8 (218) | 18 (228) | 15 (692) |
| 36-47 | 28 (179) | 4 (224) | 15 (197) | 17 (600) |
| 48-59 | 13 (207) | 4 (221) | 9 (226) | 9 (654) |
| Total | 24 (1,037) | 8 (1,032) | 15 (1,002) | 18 (3,071) |
| | **Prevalence of "Other Illnesses"** | | | |
| | % (n) | % (n) | % (n) | % (n) |
| 6-11 | 20 (145) | 21 (134) | 15 (125) | 19 (404) |
| 12-23 | 14 (261) | 18 (239) | 25 (227) | 17 (727) |
| 24-35 | 13 (247) | 16 (216) | 28 (231) | 16 (694) |
| 36-47 | 14 (179) | 11 (223) | 16 (197) | 13 (599) |
| 48-59 | 6 (206) | 6 (222) | 23 (226) | 9 (654) |
| TOTAL | 13 (1,038) | 14 (1,034) | 22 (1,006) | 15 (3,078) |

The percentages have been weighted on the basis of population proportions

NATALITY AND MORTALITY INDICES
BY STUDY GROUPS AND GEOGRAPHIC AREA

Table 10

| Geographic Area | Number of Mothers | Total Number Live Births | Average Number Live Births | Number of Deaths | Total Number Still Living | Average Number Still Living | Percent Survival | Number of Deaths Year < 1 | 1-2 | 3-5 | >5 | Percent of Mortality Years < 1 | 1-2 | 3-5 | >5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Urban Area * | | | | | | | | | | | | | | | | |
| Altiplano (La Paz) | 587 | 2,206 | 3.8 | 443 | 1,763 | 3.0 | 80% | 302 | 118 | 15 | 8 | 13.7% | 5.3% | .7% | .4% | 20.1% |
| Valle (Cochabamba) | 544 | 2,009 | 3.7 | 318 | 1,691 | 3.1 | 84% | 186 | 115 | 10 | 7 | 9.3% | 5.7% | .5% | .3% | 15.8% |
| Llano (Santa Cruz) | 612 | 2,232 | 3.6 | 268 | 1,964 | 3.2 | 88% | 144 | 108 | 9 | 7 | 6.5% | 4.8% | .4% | .3% | 12.0% |
| Rural Area | | | | | | | | | | | | | | | | |
| Altiplano | 672 | 3,169 | 4.7 | 817 | 2,352 | 3.5 | 74% | 522 | 236 | 33 | 26 | 16.5% | 7.4% | 1.0% | .8% | 25.8% |
| Valle | 587 | 2,549 | 4.3 | 486 | 2,063 | 3.5 | 81% | 278 | 168 | 25 | 15 | 10.9% | 6.6% | 1.0% | .6% | 19.1% |
| Llano | 653 | 2,931 | 4.5 | 375 | 2,556 | 3.9 | 87% | 230 | 104 | 20 | 21 | 7.8% | 3.5% | .7% | .7% | 12.8% |
| Total-Rural | 1,912 | 8,649 | 4.5 | 1,678 | 6,971 | 3.6 | 81% | 1,030 | 508 | 78 | 62 | 11.9% | 5.9% | .9% | .7% | 19.4% |

* No total since samples were not probability samples of entire area.

# FIGURE 1
## Percent of Individuals from a Normally Distributed Population Having Values Below Standard Deviations Shown. 0.0 Represents Population Mean

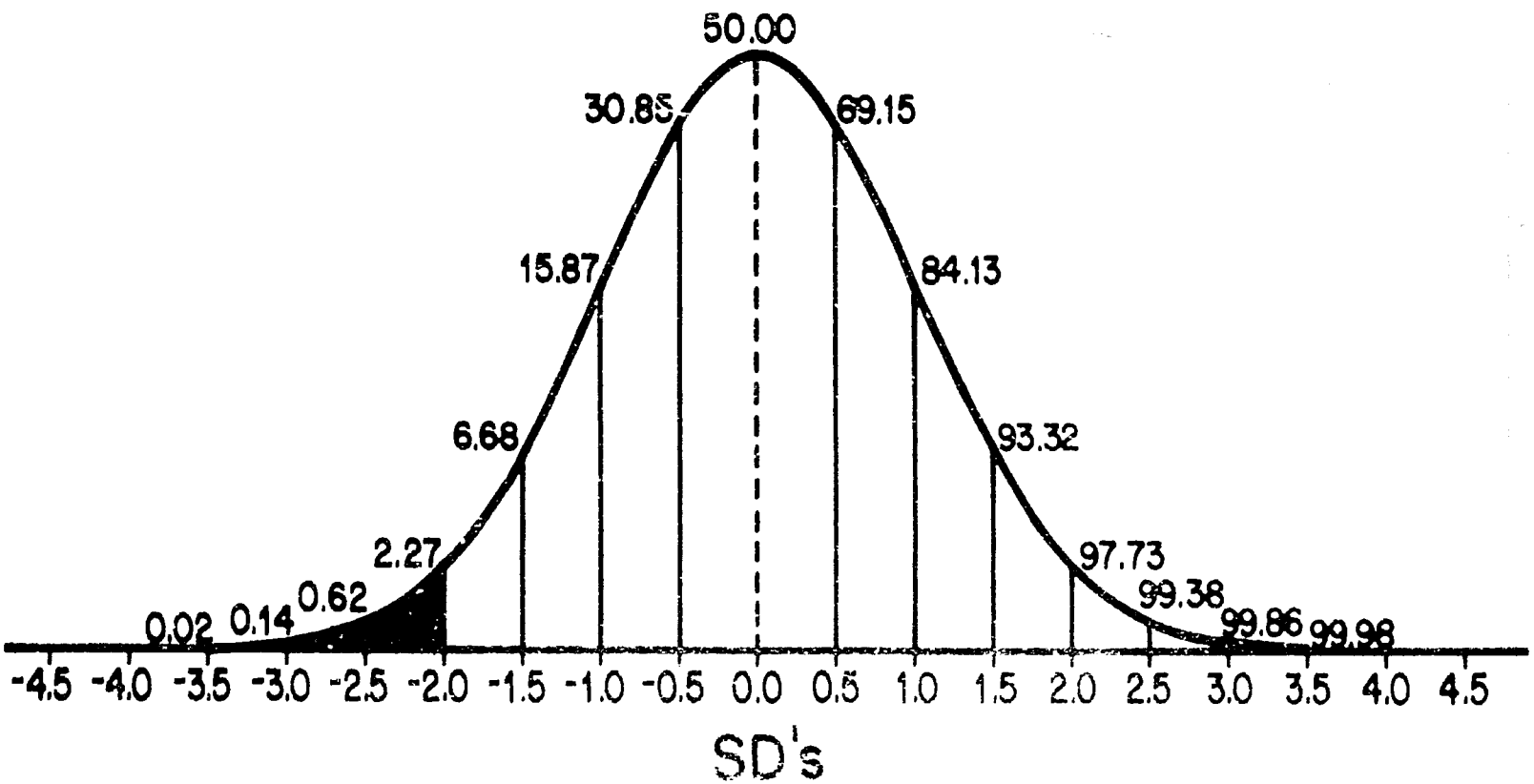

FIGURE NO. 2
PREVALENCE OF LOW STATURE
(HEIGHT FOR AGE < -2.0 STANDARD DEVIATIONS)
BY AGE AND RURAL UNIVERSES- BOLIVIA 1981

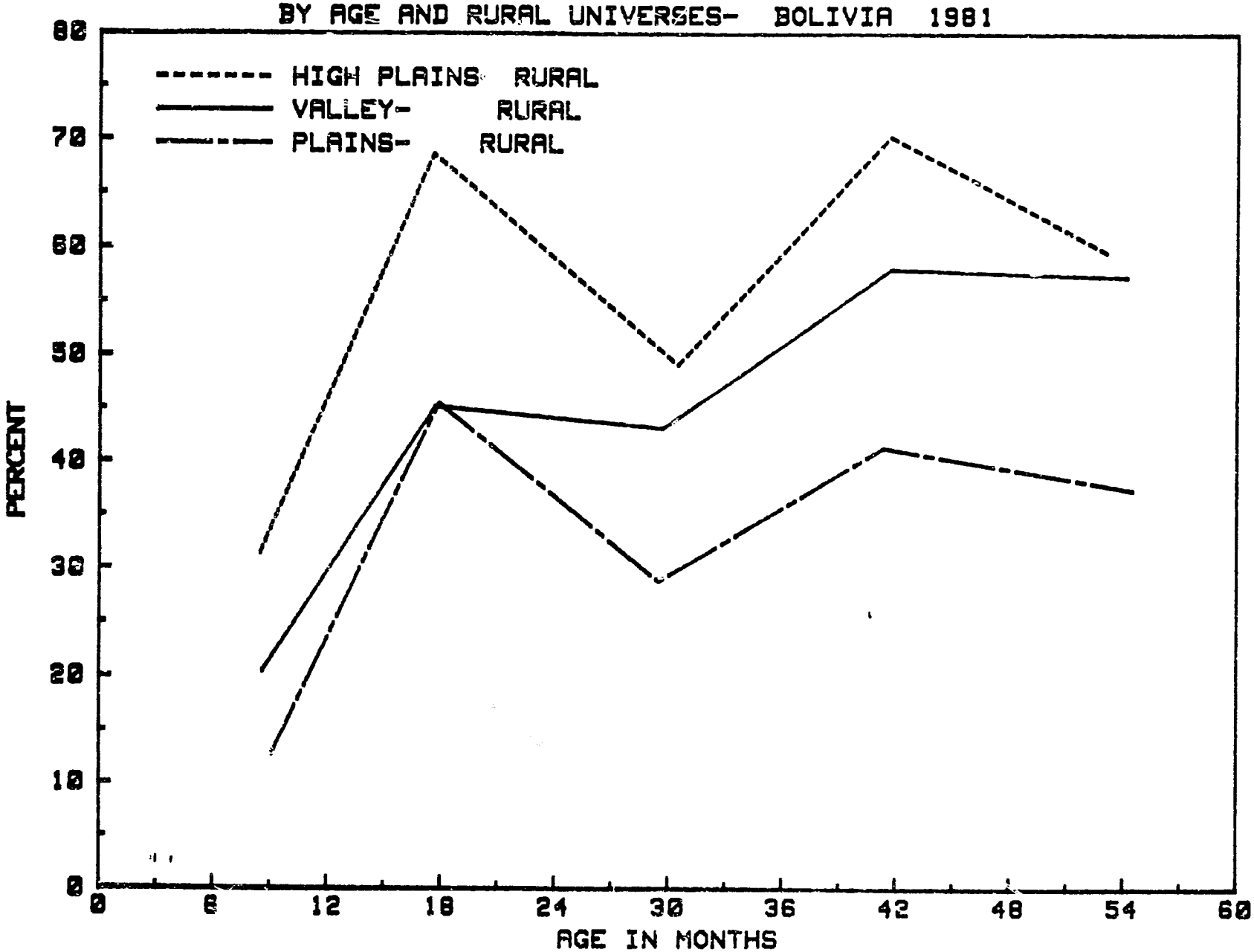

FIGURE NO. 3
PREVALENCE OF LOW STATURE
(HEIGHT FOR AGE < -2.0 STANDARD DEVIATIONS)
BY AGE AND URBAN UNIVERSE- BOLIVIA 1981