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Foreign Field Research Program
Sponsored by
Office of Naval Research
Report No. 6

An Ecological Study of Total Mortality Among Guatemalan Preschool Children, With Special Emphasis on Protein Malnutrition and Kwashiorkor

by

Herbert Slutsky

This report is a result of studies conducted under Contract Nonr-2300(09).

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AN ECOLOGICAL STUDY OF TOTAL MORTALITY AMONG GUATEMALAN PRESCHOOL CHILDREN, WITH SPECIAL EMPHASIS ON PROTEIN MALNUTRITION AND KWASHIORKOR

By

Herbert Slutsky

Urbana, Illinois

February, 1960

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL

Division of Earth Sciences

This is the sixth of a series of reports to be issued under the Foreign Field Research Program administered by the Division of Earth Sciences, with the financial sponsorship of the Geography Branch, Office of Naval Research.

AN ECOLOGICAL STUDY OF TOTAL MORTALITY AMONG GUATEMALAN PRE-SCHOOL CHILDREN, WITH SPECIAL EMPHASIS ON PROTEIN MALNUTRITION AND KWASHIORKOR.

Herbert Slutsky, Ph. D.
Department of Geography
University of Illinois, 1959

In protein malnutrition and kwashiorkor, the world is faced with a most serious and difficult public health problem. Although global in extent, its intensity varies regionally. The geographical pattern indicates that most malnutrition occurs in the technically under-developed countries of the world.

Medical geography studies the interrelations of the geographic elements that may be involved in bringing about a particular disease. From the results it attempts to arrive at practical solutions for the amelioration of illness. It follows from this definition that protein malnutrition and kwashiorkor constitute a medical geographical problem. Although the cause of these diseases is clear, the problem for the medical geographer is to explain why there are more of these conditions in one region than in another.

An ecological investigation of protein malnutrition and kwashiorkor was made in Guatemala using geographic techniques. The first step, the exploratory phase, proved that there was a geographical distribution of mortality. The genetic phase, or second step, required that certain surveys be carried out. The remedial, or third phase, served two purposes; first, it demonstrated the interrelation between nutrition and environmental factors and second, it allowed the formulation of a set of recommendations for the amelioration of illness in Guatemala.

To find out why the geographical pattern existed, a field study to explore the geographic variation in malnutrition was undertaken by a research

team of nine persons. Ten villages and towns were randomly selected, five of which were located in areas of high mortality and five in areas of low mortality. A physical examination was performed on 1193 Indian and Ladino pre-school children; 814 of whom were females. The examination included a search for signs of malnutrition, the clinical diagnosis of specific diseases, the measurement of height and weight, and an appraisal of the general nutritional status. Simultaneously, detailed information was obtained concerning the environmental factors, both physical and cultural, of each village.

This field study and comprehensive investigation of the environmental factors demonstrated that the geographical pattern of the mortality tended to coincide with the physical geography of Guatemala. A mortality rate between 70 and 90 per cent of total deaths in the Coastal Lowlands occurred in pre-school children, whereas in the Central Highlands the mortality was low, 10 to 30 per cent. The incidence of kwashiorkor was 12 per 1000 of the sample population. The nutritional condition did not influence height or weight significantly, but the data did suggest that poorly nourished children grew more slowly than well nourished children. In villages with high mortality, for all subjects, 2.3 per cent were in the excellent nutritional status, 62.3 per cent were rated good, 28.3 per cent were regular, 7.1 per cent were bad; in villages with low mortality, for all subjects, 5.9 per cent were excellent, 65.1 per cent were average, 27.6 per cent were regular, 1.4 per cent were bad. The incidence and intensity of malnutrition did not seem sufficient to account for the great difference in mortality. The variation in mortality appears to reflect a composite of many environmental factors.

ACKNOWLEDGMENTS

The author wishes to take this opportunity to express his appreciation to all those who assisted in the planning, conduct of the investigation, and the preparation of this dissertation. The original planning of the research was under the direction of Drs. John L. Page and Joseph A. Russell, Department of Geography, University of Illinois, Urbana, Illinois; Frederick Sargent II, Department of Physiology, University of Illinois, Urbana, Illinois. In this early stage Dr. Jaques M. May of the American Geographical Society was most generous with his good counsel and enthusiastic encouragement.

Support for the field research was awarded by the Foreign Field Research Program conducted by the Division of Earth Sciences, National Academy of Sciences - National Research Council and financed by the Geography Branch, Office of Naval Research, under contract NONR-2300(09) with the National Academy of Sciences.

The author owes a debt of gratitude to Dr. Nevin S. Scrimshaw, Director, Institute of Nutrition of Central America and Panama, Guatemala City, Guatemala, for his invitation to work at the Institute and assistance in initiating the actual field investigation. Our field collaborators were Drs. Werner Ascoli, Co-director; Moises Behar, Senior medical consultant; Miguel Guzman, Statistician; Adolfo Chanez, Examining physician; Samuel Castillo, Examining physician; Mrs. Berta Mendizabal, Social Worker; and Mrs. Herbert Slutsky, Secretary. In addition to establishing the statistical design of the study, Dr. Guzman and his staff transferred the medical data from the physical examination sheets to useable statistics.

Special thanks are also due to other INCAP staff members, the Guatemalan Public Health Department and Department of Statistics, for various services and courtesies rendered.

Upon return to the United States, Drs. Frederick Sargent II and John L. Page, served as the author's advisers and directed the preparation of the thesis. Mr. James Bier was responsible for the preparation of maps and Mrs. Dorothy Coslet and Patricia Archer typed the original draft. The author was aided by Mr. Arne Tonis Pessa who assisted in the statistical analysis of height, weight, and skin-fold data.

For Maurine, my wife, who actively participated in the study, my devotion for her complete faith in Herbert L. Slutsky.

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INTRODUCTION

In protein malnutrition, the world is faced with a most serious and difficult public health problem. Numerous researchers feel that this nutritional deficiency is the most important single problem in the entire field of public health. Although protein malnutrition is global in extent, its intensity varies regionally. The geographical pattern of its distribution indicates that most cases of protein deficiency are confined to the technically underdeveloped countries of the world. The importance of this problem is underlined by the fact that in these areas hundreds of thousands of children are suffering from protein malnutrition as a result of poverty, food shortages, lack of medical facilities, ignorance, and superstition. The growth of a technological civilization has done little to alleviate this critical situation and in numerous ways has actually worsened it by destroying old and well-tried beliefs without supplying the necessary means for modern nutritional practices. Protein malnutrition occurs predominately among infants and children because in them growth greatly augments bodily requirements for nutrients. Among the major manifestations of protein deficiency is kwashiorkor, a disease characterized by high mortality and serious physical and psychological scars among those who survive. Since protein malnutrition in general, and kwashiorkor in particular are primarily nutritional diseases of childhood, the principal emphasis in the present investigation is on the nutritional status and the mortality rates among infants and children

Just as the world-scale pattern of protein malnutrition and kwashiorkor reveals differences in intensity that are associated with stages of technological

development within the under-developed countries there are discrete areas of greater or lesser incidence of these disorders within single countries. Study of these small scale variations in the frequency of protein malnutrition and kwashiorkor may be used to elucidate the ecology and prevention of these deficiency diseases. Medical geography is concerned with the interrelations in space of the environmental elements that may be associated with a particular disease. The degree of geographic association between known causes and the disease itself will permit the establishment of the ecology of the disorder, and in this way become a step toward a practical solution for the amelioration of the illness. In order for medical geography to be most productive, it is necessary for the pathological physiology of the particular disease to have been described as fully as possible. In the case of kwashiorkor, the etiology has been well established. It is now known that this disease arises as a result of chronic protein and vitamin deficiency. The reason that the disease is more prevalent among children than among adults is simply that a child requires relatively large amounts of protein and vitamins to support the demands of growth. Although the cause of kwashiorkor then is clear, the problem for the medical geographer is to explain why there is more of this condition in one region than in another.

There are two possible explanations for the geographical pattern of protein malnutrition. The first deals with the effect of exogenous factors on the quality and quantity of food eaten. The food eaten may, for a variety of reasons, be inadequate with respect to the causative nutrients. Among these are soil fertility, food storage and preparation, and socio-economic

and cultural factors which effect the food habits of a family. The second deals with endogenous factors. Even though the food eaten may be adequate, qualitatively and quantitatively, a number of disturbances within the body may make it difficult for the organism to assimilate and utilize the nutrients properly. Among the causes of such conditioned malnutrition are concurrent gastrointestinal diseases, particularly parasitism. Thus, the important contribution of medical geography to the problem of kwashiorkor would be that, as a consequence of a better understanding of the complicated interaction of the exogenous and endogenous factors, a practical program for the erradication and prevention of malnutrition might result.

Plan of Investigation: In order to make this nutritional problem manageable, it was decided to study protein malnutrition and kwashiorkor in a limited region where the incidence of these diseases was high. The Central American country of Guatemala was selected for two reasons. First, the intensity of malnutrition and kwashiorkor was reported to be high and second, the Institute of Nutrition of Central America and Panama, one of the outstanding research centers of its kind, was located in Guatemala City.

The facts that malnutrition was reported to be widespread in Guatemala, that 30 per cent of children in rural villages died before their fifth birthday, and that 51.2 per cent of all deaths in the entire country occurred in children under six years of age were all challenging. Was the high mortality a direct consequence of malnutrition, or did malnutrition rather act to predispose the young persons to parasitic infections which were the primary causes of death? Since a review of the literature revealed that very little information

concerning the geographical and socio-economic factors that affect the health of the Guatemalan population was available, it was considered desirable to undertake a broad ecological investigation of these questions in Guatemala and to employ geographic techniques in an effort to answer them. The first step, the exploratory phase, would either prove or disprove that there was a "geography" of malnutrition and kwashiorkor within the country of Guatemala, i.e., that there are recognizable and measurable differences in intensity from place to place. Such specific evidence for protein malnutrition and kwashiorkor was not available, but mortality figures, by age groups, for the 22 departments and 322 municipalities of the country were supplied by the Guatemalan Public Health Department. It was thought that the death rate in Guatemala in the age group of pre-school children, one to six years of age, would be a critical measure of the nutritional status of the country's population. Upon the transfer of these data to a map, a regionalization of mortality within the country became apparent. (See Figure 14.)

In order to begin the collection of the evidence that would explain why these patterns existed in Guatemala, the genetic phase, or second step, required that certain surveys be carried out. It was proposed to investigate 10 villages, each having approximately 200 to 300 pre-school children. Five villages or towns with a high mortality rate and five with a lower rate were to be arbitrarily selected on the basis of location, population, and accessibility. Randomly selected children were to be given a medical survey by qualified physicians; the survey included a physical examination, anthropometric measurements, and an assessment of the child's nutritional status.

Concurrently, an inventory of the environmental and socio-economic factors within the vicinity of the selected communities would be made. To obtain a broader picture of these factors found within the region, ancillary data (census, trade, medical and social facilities, agricultural changes, and transportational developments) would be obtained from official governmental agencies, when available. All the material would then be analyzed in an effort to determine whether the geographical patterns of the environmental and socio-economic factors coincided with the distribution of malnutrition.

Finally, it was hoped that the information obtained from such an ecological study would serve two purposes. First, that the diversified aspects of protein malnutrition and kwashiorkor in Guatemala would be more fully understood and, second, it was hoped that a medical geographical study of one country's particular patterns might serve to promote a better understanding of the global problems of protein malnutrition and kwashiorkor.

CHAPTER I

ENVIRONMENTAL ELEMENTS

> Tierra en perpetua primavera. El suelo es el escenario principal de las actividades de la vida humana, y ejerce gran influencia sobre todas actividades. Tierra donde el pasado y el presente viven en concivencia...[1]

Guatemala lies immediately south-east of Mexico, with Honduras and El Salvador beyond its south-eastern boundaries (Figure 1). On its north-eastern coast lies the Caribbean Sea, while its south-west shores border the Pacific Ocean. Guatemala, the north-western most republic of Central America, occupies an area comprising 42,042 square miles, approximately equal in size to the state of Ohio.[2] Within its boundaries are found mountain ranges with 13,000-foot peaks, deep canyons, plains, coastal lowlands and plateaus, in addition to numerous hydrographic features.

The understanding of the ecology of an organism requires the study of both the organism and the environmental circumstances among which the organism is placed. Likewise, medical geographical research on the ecology of a physiological disorder requires a consideration of the pertinent physical and human conditions that provide the environment within which the disorder exists.

Protein malnutrition is caused by protein and vitamin deficiencies in the diet. These deficiencies result from the amount and kind of foods ingested

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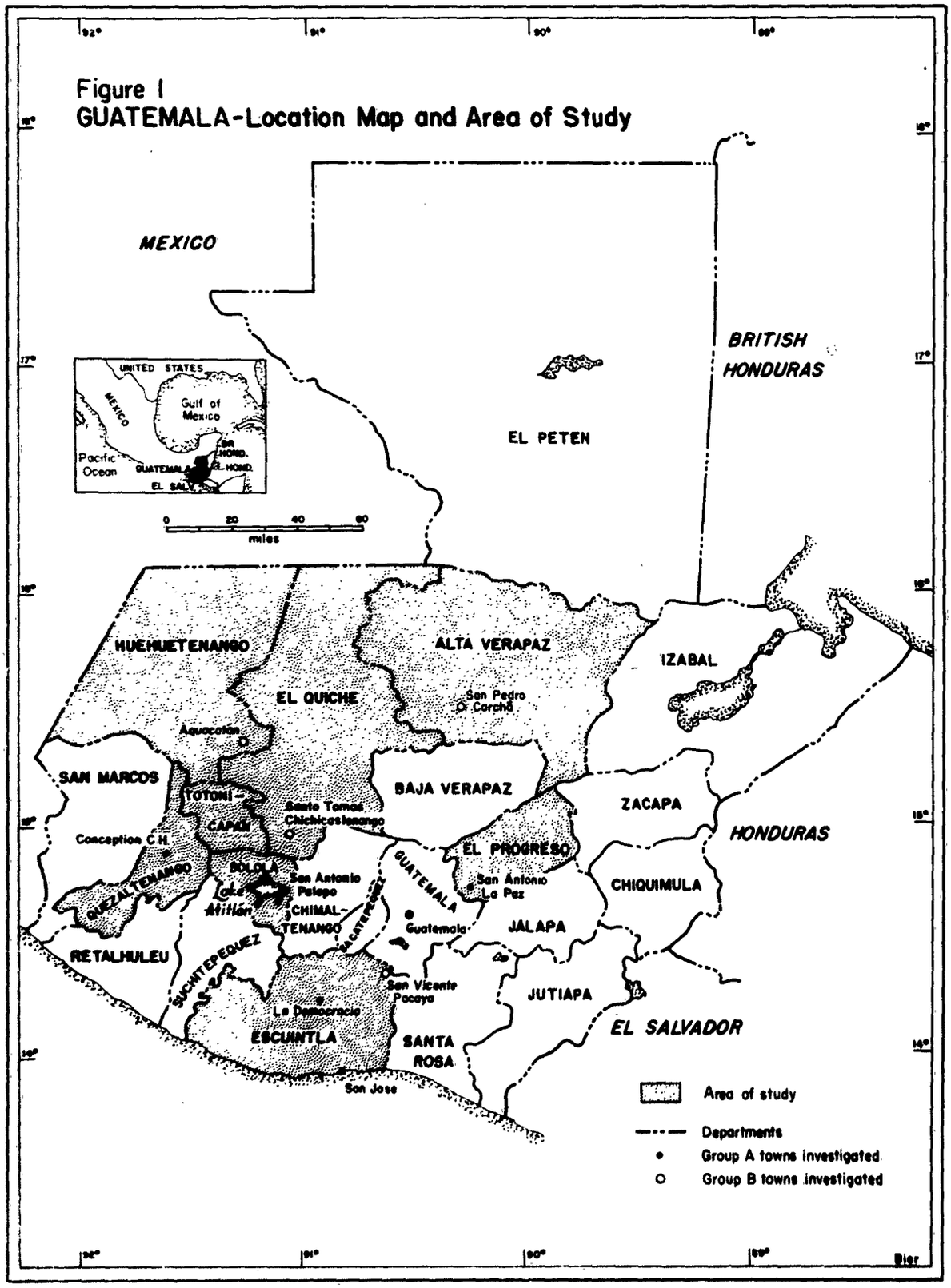
[1] "Land of eternal spring. The soil is the principal basis for the activities of human life, and it exerts a great influence over all activities. Land where today and the day before yesterday live side by side."

[2] Guatemala, Direccion General de Estadistica, Guatemala en Cifras, 1956, (Guatemala City. October, 1956), p. 14.

Figure 1
GUATEMALA-Location Map and Area of Study



and from the benefit derived from that food. Thus the agricultural system that provides the food, the culture traits that govern its preparation, the economic system that makes food available, and the general state of the human organism using the food become the foci of investigation into the problem. The brief general description of physical, economic, and cultural conditions in Guatemala in this chapter is limited to those aspects of the area which are directly related to an understanding of these foci. Detailed accounts of the impacts of these conditions are reserved for Chapter II in which the Guatemalan diet is examined thoroughly.

NON-REGIONAL ELEMENTS

Population. In 1956, the Guatemalan population was 3,258,010;[3] This was approximately 35 per cent of the total inhabitants of Central America. Population density was 17 persons per square mile, second only to El Salvador with its 56. The population was concentrated largely in the Central Highlands where areas in the vicinity of Guatemala City approach 150 per square mile. Other areas have populations as high as 50 to 75 per square mile.

Urban and Rural Population: Less than 25 per cent of the country's population was urban, and almost three-fourths of these were concentrated in Guatemala City.[4] Over 50 per cent of the rural population was located

[3] Guatemala, Direccion General de Estadistica, Sexto Censo de Poblacion, (Guatemala: April 18, 1950), p. 18.

[4] Ibid., p 20.

in the Central Highlands; departments having the largest such population were Quezeltenango, Huehuetenango, Guatemala, and Sacatepequez.

Ethnic Groups: Slightly more than one-half of the population was Indian of Mayan and Quiche stock. In urban communities they comprised only about one-fourth, while in rural areas almost two-thirds of the total.[5]

A distinction is made between the two groups of people who constitute virtually the entire population of Guatemala. These are Indians and Ladinos. The Indians are the descendants of the people who were in possession of the country in 1524 when the Spanish conquerers came. The word Ladino, translated from Spanish, means "the new language." An individual who speaks a language other than his own, is known as a Ladino. The meaning has been extended to include customs as well as language. Such people are of mixed ancestral backgrounds.

The Indian population of Guatemala lives in communities in which they retain their ethnic identity. Their separateness from the Ladinos is expressed in a unified social-political-religious system, in a distinguishing mode of dress or costume, in the use of Indian dialects, and in cultural meanings and beliefs not shared by Ladinos. There has been a small but steady acculturation of the Indian to the Ladino class. In the census of 1893, Indians constituted 65 per cent of the total population; in 1940, 56 per cent; and in 1950, 53.6.[6]

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[5] Ibid., p. 26.

[6] Ibid., p 31.

Cultural Characteristics: The most common language spoken is Spanish. Approximately 40 per cent of the total population speaks an Indian dialect, while only 0.2 per cent speaks another language, generally English. The most common dialect or native tongue is Quiche, with Mam, Cakchiqual, Kebchi, and Caribe also spoken.[7]

Economic Characteristics: Approximately 45 per cent of the total population was employed or was looking for employment. Of the total working population, 68.1 per cent was engaged in agricultural activities, 16.6 per cent in manufacturing, 9.9 per cent in services, and 5.4 per cent in retail businesses. The greatest number of male workers were employed in agriculture and construction; females exceeded males in manufacturing, retail business, and services.[8]

History. The descendents of the Maya tribes have retained the ancient customs and languages of their ancestors.[9] Guatemala also has a modern, cosmopolitan society of Spanish American Guatemalans, some of whose forefathers were among the conquistadores. These represent the extreme levels of society in the country.

The capital city, because of a flood and an earthquake, has had three different and distinct locations.

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[7] Ibid., p. 50.

[8] Ibid., p. 61.

[9] Ibid., p. 21.

Guatemala became an independent republic in 1841 through the dissolution of a federation with El Salvador, Honduras, Nicaragua, and Costa Rica which had existed for the previous 20 years.

Government. The country is organized, politically, under a republican form of government, with its customary executive, legislative, and judicial branches.[10] The President is elected for a six-year term. He is assisted in an advisory capacity by a Council of State and the Secretaries of Agriculture, Finance, Foreign Affairs, Interior, Public Education, Public Works and Communications, and War. The National Legislative Assembly, one member for each 50,000 inhabitants, is elected by popular vote. The Supreme Court has five justices, appointed for four-year terms by the assembly.

Guatemala is divided into 22 departments and 322 municipalities, the first governed by "jefes politicos" (executive head of a department) and the latter by "intendentes municipales" (equivalent to the mayor of a municipality) who guarantee to citizens the exercise of their rights in an atmosphere of peace, order, and lawfulness.[11]

The government of Guatemala functions locally through the municipio (township) and the municipalid (town board). In communities with large Indian populations there are often two municipalidades, each with an alcalde, or mayor. This double administration dates from the early days of the

[10] Vera Kelsey and Lilly De Jongh Osborne, Four Keys to Guatemala (New York: Funk and Wagnalls Company, 1952), pp. 213-214.

[11] Ibid., pp. 63-64.

Spanish conquest when it was decreed that the Indians should appoint from their number, certain officials, who should deal with minor offenses among themselves, according to their custom. Thus, today there are towns and villages of Ladino characteristics, with only a Ladino mayor, towns of Indian and Ladino outlook, with both Ladino and Indian mayors, and small villages of purely Indian attitudes, with an Indian mayor. The town secretary in Indian villages and towns is appointed by the central government. He receives a salary and is invariably a literate, Spanish-speaking individual who serves both as interpreter and as official scribe for the Indian municipal authorities. He is often not a native of the town and is usually a Ladino.

Although the central government does not intervene directly in the Indian municipal government, officers elected by the Indian population are, nevertheless, subject to the jurisdiction of the "jefe politico." As the representative of the president, he avails himself of the Indian administration for the use of the central government.

In the towns and villages having both Indian and Ladino mayors, all Indian administration stems from the municipal council. This council is presided over by the Indian mayor who, elected annually, is the community judge. He has the power to imprison, sentence to forced labor on public projects such as roads, and to fine. The council is composed of elders who are elected annually. They serve in weekly rotation and are concerned chiefly with the administration of the numerous cantons into which the township is divided. Each canton is under the jurisdiction of a chief man and is subdivided into an eastern and a western division, each of which is under the supervision of a subchief.

The secretary is the only official not annually elected. The auxilliaries of the two mayors serve alternately by the week and perform duties designed to relieve the mayors of their many responsibilities. Certain men of the town are assigned specific duties such as supplying firewood, collecting pine needles to spread on the floors of public buildings during celebrations, and running errands. In addition, two men serving as religious officers, act in an advisory capacity to the Indian mayor.

The Indian village or town in Guatemala is very closely knit. The community resists outside influence and modern innovations, desiring to continue the customs of their ancestors without interference. Indian townships are aided in their preservation by the exercise, within broad limits, of self-government. Intrusion of outside influences into town affairs is strongly opposed by the community and the Indians' capacity for passive resistance. The power of the community, developed through unanimity of thought and action, is well recognized by the central government, which has granted concessions in return for other services rendered. The result has been the preservation of an indigenous population that otherwise would have long since lost its individuality.

While the population is the second largest of the Central American countries, the distribution is such as to isolate most except in or near the larger urban centers. Most of these centers are in the Central Highlands area. The Indians have tended to maintain their identity generation after generation without marked effort to improve their mode of life or to alter their cultural level The fact that they are very largely in rural rather than urban areas has encouraged this lack of change. Even their economic

pursuits are agricultural, primarily subsistence. This gives them little more than a bare existence.

The type of governmental organization and operation gives to each municipality a certain amount of autonomy, but without finances and authority to materially improve its lot. Thus, a low standard of living is maintained and this condition is reflected in poor transportation, poor housing, poor sanitation, and an inadequate diet.

REGIONAL ELEMENTS

Topographically, Guatemala is one of the world's more complicated areas.[12,13,14,15] It consists of seven regions: 1) The Peten and Caribbean Lowlands, 2) The Central Highlands, 3) The Cuchumatanes Paramo, 4) The Southeastern Uplands, 5) The Eastern Slopes of the Central Highlands, the Zona Reina Hills and Alta Verapaz, 6) The Pacific Piedmont, and 7) The Pacific Coastal Plain (Figure 2).

The remainder of this chapter will use the framework of Guatemala topographic regions (Figure 2) to bring together data on climate, soils, vegetation, hydrology, and agriculture as these features contribute to an understanding of the problem of protein malnutrition and kwashiorkor in Guatemala.

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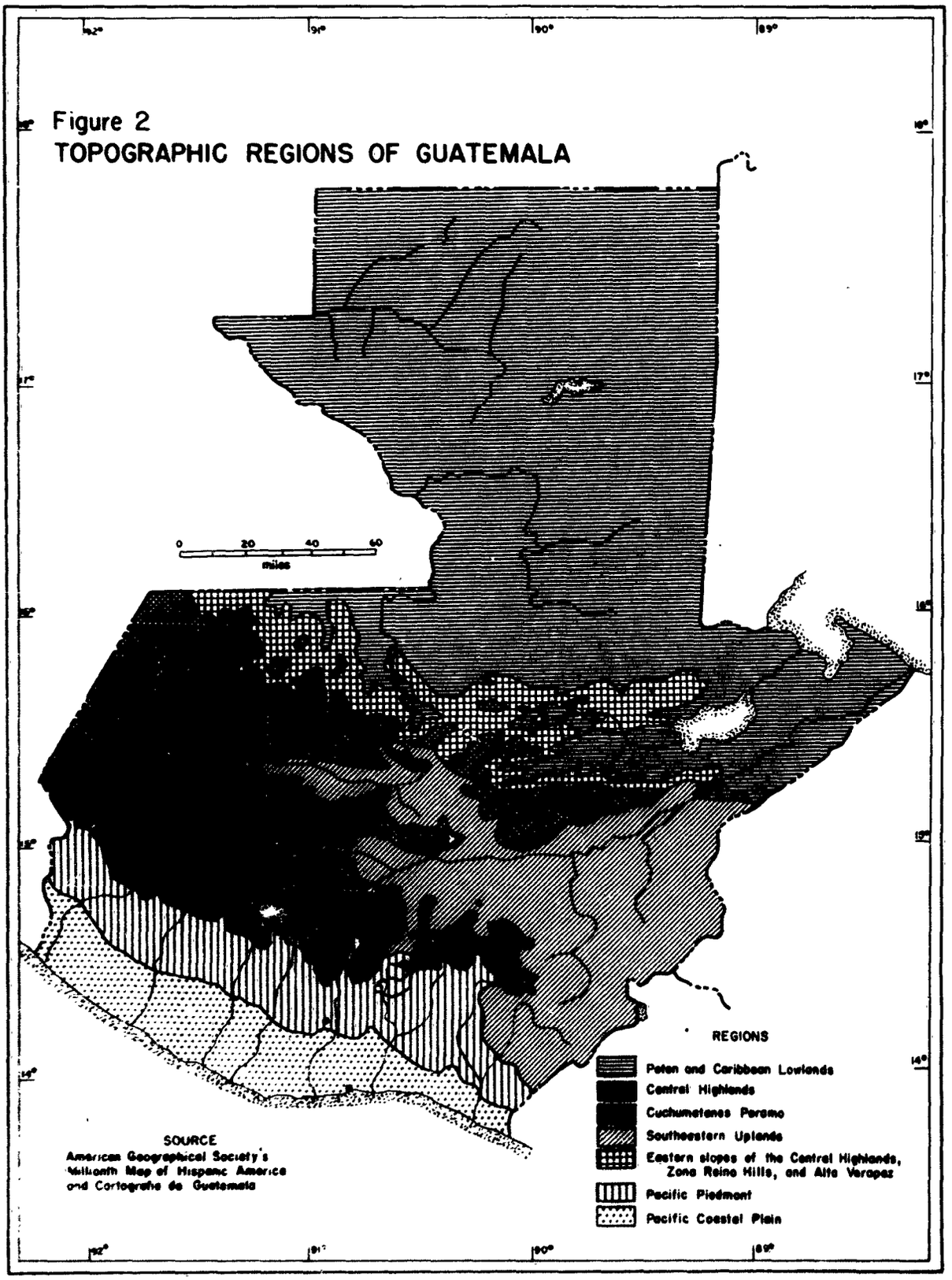
[12] Charles Schuchert, Historical Geology of the Antillean-Caribbean Region (New York: John Wiley and Sons, Inc., 1935), pp. 364-372.

[13] Preston E. James, Latin America, (New York: The Odyssey Press, 1942), p. 577.

[14] Schuchert, op cit., p. 364.

[15] Karl Sapper, Grundzuge der Physikalische Geographie von Guatemala, (Berlin, Petermann's Mitteilung, 1894), pp. 1-59.

Figure 2
TOPOGRAPHIC REGIONS OF GUATEMALA



The Peten and Caribbean Lowlands topographic region (Figure 2) embraces almost half of the total area of the country. This is the only region having direct access to the Caribbean.[16] Most of the area is below 1,500 feet elevation.

Its general location and elevation results in a climate with high temperatures throughout the year. The absence of topographic barriers to the east enable it to receive winds directly from the Caribbean Sea producing rather abundant precipitation (50 to 95 inches), more than 70 per cent of which falls during the period June through November.[17]

The topographic and climatic conditions have encouraged extensive tropical hardwood forests.[18,19] As yet, they are contributing little to the economy of this region, or to the country as a whole. They may have considerable potential.

With few exceptions this region is one of fertile, residual calcareous clay soils (Figure 3), capable of extensive agricultural development.[20] To date there is only a very small portion devoted to agricultural activities; this in the area close to the Caribbean coast where commercial banana plantations exist (Figure 4).

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[16] Guatemala, Direccion General De Estadistica, op. cit., p. 9.

[17] Guatemala, "Informaciones Meteorological de la ciudad de Guatemala", Estadistaca, Mensaje Quincenal de Estadistica, No. 129, July 31, 1956, p. 4.

[18] Julian A. Steyermark and Paul C. Standley, "The flora of Guatemala," Ecology, Vol. XXXI, July, 1950, pp. 368-372.

[19] E. C. Higbee, "The Agricultural Regions of Guatemala," The Geographical Review, Vol. XXXVII, No. 2, April, 1947, pp. 177-201.

[20] Charles S. Simmons, Jose Tarano, and J. Humberto Pinto, Reconnaissance Soil Survey of Guatemala (Guatemala: Servicio Intramericano de Agricultura, 1957), p. 2.

Figure 3
SOIL MAP OF GUATEMALA

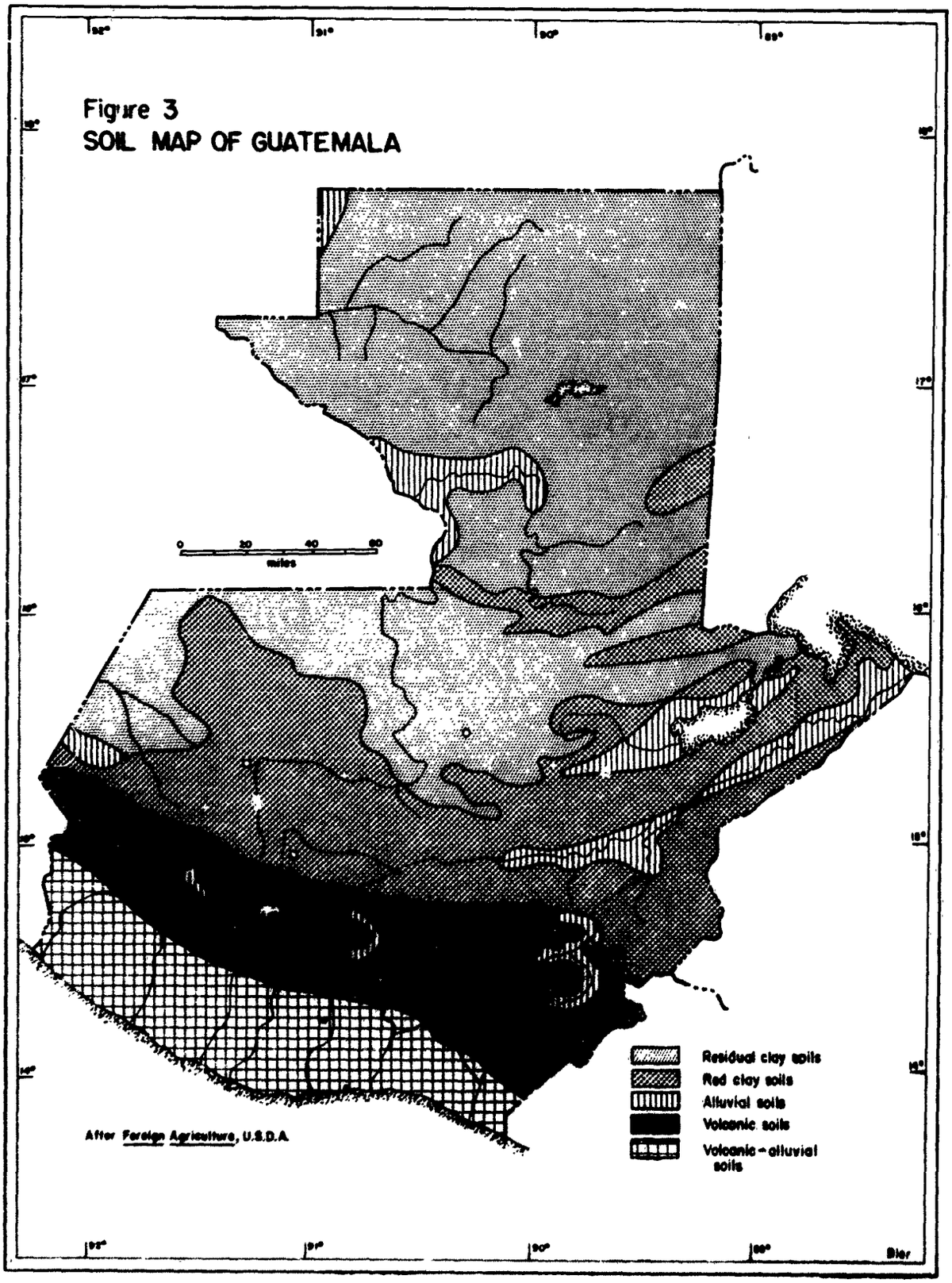
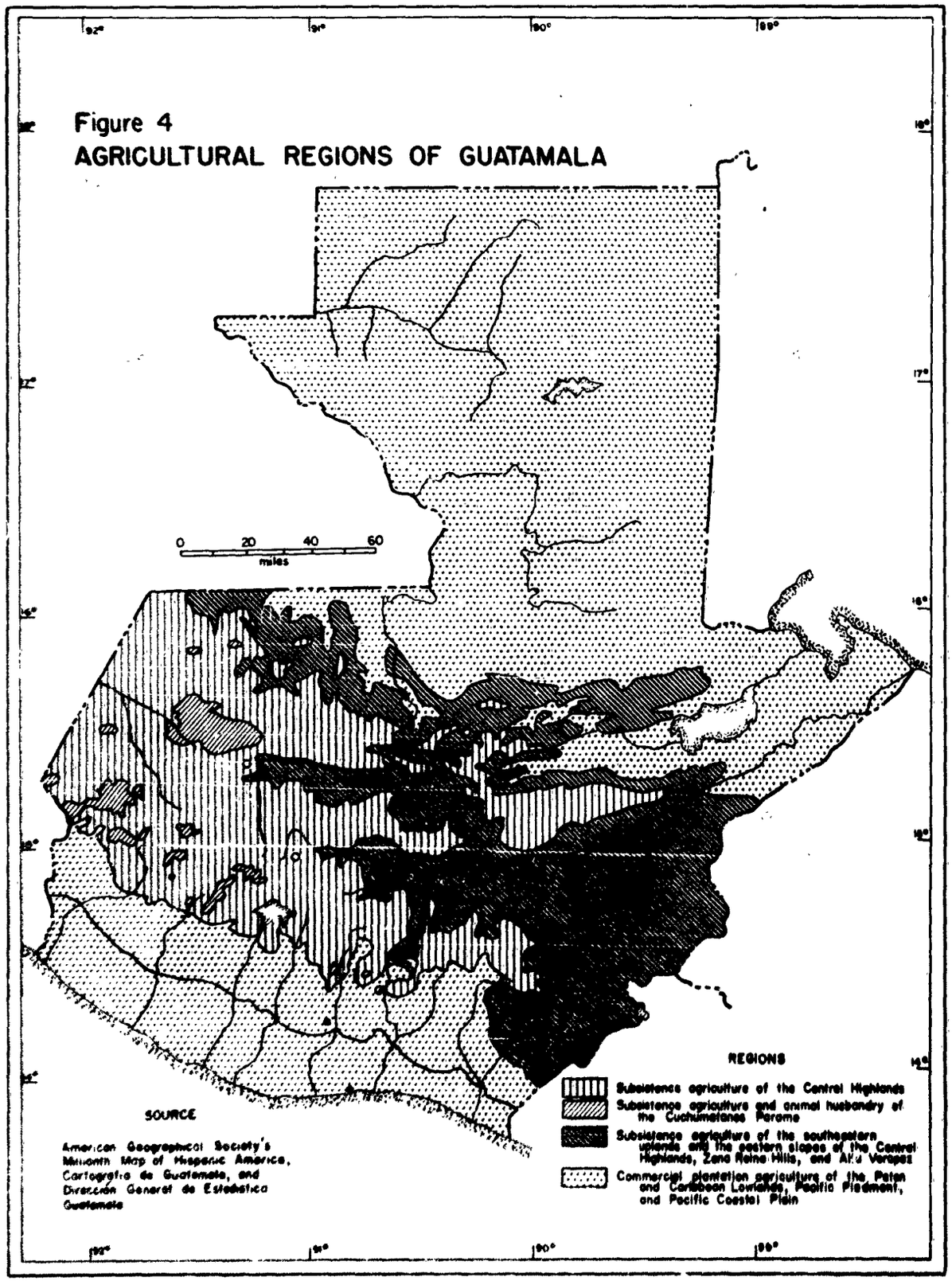


Figure 4
AGRICULTURAL REGIONS OF GUATAMALA



Population densities are the lowest in the country, less than five persons per square mile. The region as a whole is the most isolated one in the country and direct connection with Guatemala City is possible only by air. Roads are non-existent and local rivers afford the only means of transportation for the inhabitants. A short, narrow-gauge railroad has been built to facilitate banana shipments to the port city of Puerto Barrios, but is little used by the Indian farmers.

The Central Highlands (Figure 2), marked by a complex of ridges and valleys,[21,22] rise above the lowlands and comprise about 20 per cent of the total area. The region consists of rocky, untillable, forested mountainsides, and numerous steep, eroded ravines. Several dispersed lakes and lagoons which are found within the area are subject to substantial annual variations in volume.[23]

The rocky, untillable mountainsides of the Central Highlands are unproductive.[24] Cultivated land, lying on the crests and gentler slopes of worn down, rolling hills, is eroded and impoverished. Good soils are limited to a few small areas; the best are found in the intermountain valley plains and river terraces, extending from Totonicapan to the west of Quezaltenango

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[21] Karl Sapper, "Die Alta Verapaz," Geographische Gesellschaft, Vol. XVII, January, 1901, p. 82.

[22] Sidney Powers, "Notes on the Geology of Eastern Guatemala and Northwestern Honduras," Journal of Geography, Vol. XXVI, January, 1918, pp. 507-523.

[23] Guatemala, Direccion General De Estadistica, op. cit., p. 12.

[24] Schuchert, op. cit., p. 333.

(Figure 3). Ranking next in quality are the several intermountain plains where deep soils are derived from volcanic material. Other small areas of productive soils are found in and near the department capitals of Huehuetenango, San Marcos, Santa Cruz del Quiche, and Solola.

More than 60 per cent of the total population of the country lives within this region, which lies between 4,000 and 8,000 feet elevation. Densities as high as 150 persons per square mile exist. Except for sugar and bananas, most of the subsistence crops of the country are produced here. The complex and varied topographic features of this region impose definite limitations on agricultural development. Despite these limitations, the large agrarian population has utilized extensive areas for crop production which probably should not have been so used.[25]

Climate also places limitations on the variety of crops that may be produced. The variation in rainfall, from a low annual average of less than 15 inches to as much as 200 inches[26] and a temperature reflecting the effect of elevation from 4,000 to 8,000 feet permit production of a great variety, but not a self-sufficing quantity. Nearly the whole area suffers from a dry season from December to June. At the higher altitudes heavy mists and dews make the soil sufficiently moist to germinate seed and support plant growth until the rainy season begins. This condition permits the cultivation of corn nearly to the summer frost line, where as much

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[25] Higbee, op. cit., pp. 180-184.

[26] Guatemala, "Informaciones meteorological de la ciudad de Guatemala," op. cit., p. 5.

as eight or nine months may be required for a crop to mature.[27] Pressure of population has been the factor forcing crop production almost to the frost line.

Farm tenancy is widespread. More than half of the farm population are share-croppers or work as laborers on farms other than their own. This is a region of subsistence agriculture (Figure 4). The inadequate farm sizes, steep slopes, extensive erosion and gullying, and traditional production methods have made it impossible for thousands of Indians to grow enough food for themselves. They are forced to migrate seasonally to other areas for cash income.[28]

The region of the Cuchumatanes Paramo (Figure 2) is the higher portions of the Cordilleras crossing the country from west to east. The elevation is generally above 8,000 feet, slopes are steep, soils are red clay as well as volcanic (Figure 3), but thin and eroded.

Temperatures, controlled by altitude, are reported to vary from the high 50's to frosts every month of the year. Precipitation is low and falls principally from June through December. A temperate savanna grassland results where there is any vegetation cover.

Topographic and climatic conditions restrict the use of this region largely to subsistence agriculture and animal husbandry (Figure 4). Only in the lower portions can corn be grown. Even here it is often damaged by

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[27] Francis Le Beau, "Agricultura de Guatemala," Integracion Social en Guatemala, ed. Jorge Luis Arriola, (Guatemala: Integracion Social Guatemalteca, 1956), pp. 275-280.

[28] Refer to Chapter V for a more detailed explanation.

frost. Potatoes are produced at all elevations where small patches of ground are sufficiently level. Sheep herding on the savannas is important in the Indian economy. Almost none of the meat is sold or consumed by the Indians. The wool is sold to the owner of the pasture. From its sale, the Indian is able to purchase some of the foods which he cannot produce at such elevations.

The Indian rents land on which to build a house which is traditionally adobe. He also has a small piece of ground adjacent to his house on which he grows potatoes. It is not uncommon for him to rent some corn and wheat land at lower elevations to supplement his food supply.[29, 30]

Aside from portions of Peten, no region of Guatemala is more isolated than this. The major portion of the few people who live here have never been out of the region.

The Southeastern Uplands region (Figure 2) varies in elevation from 900 to 4,500 feet. Deep ravines, numerous rivers and streams, lakes, and extinct, eroded volcanic cones have produced a complex and diverse topographic appearance. The soils are calcareous red clays and alluvium (Figure 3). The most productive soils are on river terraces, on inclined, gullied plains skirting mountain foothills, and on lake shores. Since most of the region is unfit for permanent agriculture, it has been abandoned to cut over scrub bush and grass.

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[29] Higbee, op. cit., pp. 184-185.

[30] Felix Webster McBryde, Cultural and Historical Geography of Southwest Guatemala (Washington: Institute of Social Anthropology, June, 1945), p. 38.

Population density is low, less than 20 persons per square mile. It is a predominately Ladino region. However, small isolated Indian communities exist in the higher elevations. Agriculture is essentially on a subsistence basis (Figure 4) It is more nearly self-sufficient in its agricultural needs than is the Central Highlands region. Occasionally there are crop surpluses which provide an important source of money to the local economy. Distance from the Central Highland markets and the lack of adequate transportation have prevented it from becoming a region of commercial production.[31]

The region of the Eastern Slopes of the Central Highlands, Zona Reina Hills, and Alta Verapaz (Figure 2) has approximately the same altitudinal limits, 900 to 4,500 feet, as the Southeastern Uplands. Its topography is one of hill and valley arrangement, complicated by extensive erosion. There is a general lack of any specific data regarding climate. The soils are generally shallow and unproductive. The best of them are in the depressions and on the gentle, lower slopes of hills. Much of the vegetation is cacti, dense desert shrubs, and short savanna grasses.

This region has less than 20 people per square mile, most of whom are Ladino. Occasional isolated Indian communities exist at higher elevations. Because of its small population and because of its isolation from the more densely populated areas of Guatemala, the region has remained one of self-sufficient agriculture (Figure A).

The remaining topographic regions of Guatemala, the Pacific

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[31] Refer to Chapter V for a more detailed explanation.

Piedmont and the Pacific Coastal Plain (Figure 2), differ from each other primarily in degree rather than kind. The Piedmont is higher in elevation and reveals evidences of erosion, while the Coastal Plain is characterized more by depositional features. These two regions have very striking uniformity in soils (Figure 3) and in agriculture (Figure 4). Differences in climate are also of degree rather than kind. Therefore, the two topographic regions will be discussed as though they were one.

The topography of the two regions is one of a piedmont that changes into a coastal plain. Although both are areas of gentle slope, erosion is more prominent in the piedmont. Soils are among the finest in Guatemala and are derived from deep accumulation of volcanic alluvium. When the streams overflow, additional fertile alluvium is added to the regions. The rivers that do flow into the Pacific Ocean are numerous, but are short and carry a small volume of water. Only where rivers rise at sufficient elevation in the Highlands is it possible to capitalize on their flow to create hydro-electric power.

Precipitation is received primarily in the summer half year, with the amounts ranging from 70 inches on the Coastal Plain to as much as 150 inches in the upper elevations of the Piedmont. Both regions experience frequent heavy downpours of rain in the afternoon hours.

The vegetation is marked by mixed hardwood and palm forests and tropical savanna grasses. Swamps are numerous along the entire extent of the coast, while forests are more abundant near and along stream courses.

Commercial plantation agriculture characterizes this region.[32] The

[32] George E. Britnell et al., The Economic Development of Guatemala (Baltimore: Johns Hopkins Press, 1951), p. 205.

products that leave the country are bananas and coffee, while those that go primarily to the markets in the Central Highlands are cattle, cotton, and sugar. This agricultural system is based on large land holding, a transportation system designed to meet its own needs, and on a rather large migratory labor supply during certain periods of the year. This, likewise, virtually eliminates the small farmer. All of the above factors contribute to a low density of rural population as well as to few urban centers.[33]

The discussion of the seven topographic regions and their associated climate, soils, vegetation, agriculture, and hydrology point up certain more or less common characteristics. Indians and Ladinos are engaged in subsistence agriculture, in places, supplementing their income by working on plantations as migratory laborers. They are generally found in the most isolated areas. This isolation results from the high altitudes or the almost inaccessible valleys where some land, level enough for use, may be found. These conditions lead to poverty to such a degree that the people themselves can not provide transportation facilities nor is there sufficient economic pressure to force the central government to provide them. They have little of their own, know little of what the outside areas are like, and consequently, know not how to change their pattern of life from that of their Mayan ancestors.

[33]These factors are explained in greater detail in a discussion of the villages and towns in Chapter V.

CHAPTER II

ADEQUACY OF THE GUATEMALAN DIET

Food Production. Since Guatemala has relatively large areas of unused land, a variety of soils, more than adequate rainfall, and a varied agriculture, many have taken for granted that Guatemala can provide sufficient food to meet the populations needs, that agriculture can automatically expand and provide adequately for the growing population, and can at the same time, produce enough exports to supply the foreign exchange necessary for the country's development.

The population of Guatemala is annually increasing at the rate of 2.7 per cent, or doubling in size approximately every 30 years.[34] The demand for food is increasing correspondingly, and simultaneously a growing urban population is demanding better and more expensive foods. Agricultural production could be greatly increased by raising the yields and bringing more land under cultivation. If the present agricultural methods and practices are continued however, it is improbable that food production can be doubled every 30 years. Thus, whatever the rate of increase, food production will not meet the needs of the growing population. This conclusion is supported by the results of the periodic dietary surveys made by such agencies as INCAP. These surveys indicate that during the last four years 1956 to 1957, a 2.5 percent increase in the total agricultural output occurred, most of which was in basic foodstuffs. Since this increase in production did not exceed the population growth, the discrepancy between food production and food requirements remained unchanged.

[34] Guatemala, Direccion General de Estadistica, op. cit., p. 21.

Sources of Information: In order to examine in some detail the nutritional problems which have resulted from the wide discrepancy between the curves of population growth and food production, the individual foods which are produced in Guatemala must be considered. The production figures have been compiled by official agencies of the local government for the years 1950 through 1956. In the following paragraphs, information contained in reports from the Department of Statistics, Agricultural Censuses, and Supplementary Census Reports of 1950, 1955, and 1956 has been utilized.

Milk: Milk production in 1950 was 85,000,000 liters.[35] The amount of milk processed for butter and cream was small. Very little milk was fed to animals and exports of milk and milk products were negligible. In 1956, recorded milk shipments to Guatemala City amounted to approximately nine million liters. Dietary surveys have shown that milk consumption in rural areas is very low; in isolated regions milk is virtually unknown. Taking figures on their face value the daily consumption by the rural population is of the order of 0.7 liters per person. This figure is inadequate by INCAP standards (see Table 1).

In 1950 there were 428,000 cows and heifers, of which 185,000 were milch cows.[36] Of this number, only 81,000 cows were milked and yielded over 200,000 liters of milk per day. In 1956 there were 219,000 milch cows. Of these 89,000 produced 236,000 liters of milk. Average production

[35] Guatemala, Direccion General de Estadistica, Censo Agropecuario: 1950, Ganderia, Vol. II, (Guatemala City: August, 1954), pp. 31-40.

[36] Ibid., pp. 11 and 31.

per milch cow was 2.6 liters per day in 1950 as compared to 2.7 liters per day in 1956.

Meat: In 1950 meat production and consumption were equal at 906,000 quintales.[37] This figure represented the total carcass weight of cattle of all ages, pigs, sheep, and goats reported slaughtered by licensed butchers.

There is evidence that these figures on meat consumption are probably low. In the first place, there was certainly unreported slaughter of animals on farms and in remote and isolated villages. In 1950 more than 15,000 head of cattle and 24,000 pigs, sheep and goats were killed and presumably were not reported to the municipal authorities. In the second place, no allowance was made for poultry. Poultry is ubiquitous in Guatemala. In 1956 it was kept on over 300,000 farms.[38]

Eggs: Over a five-year period 1950 to 1956 total egg production per year varied from 15 million dozen to 33 million dozen. Approximately one million dozen were hatched for breeding purposes. Breakage amounted to ten per cent of the total production. Net consumption averaged 104 eggs per person per year.

Beans: From 1950 to 1956 the total bean production averaged 512,000 quintales per year. Approximately 62,000 manzanas[39,40] were harvested,

[37] Unit of dry measurement; 1 quintal = 101 lbs.

[38] Guatemala, Censo Agropecuario: 1950, op. cit., p. 11-27.

[39] One manzana = 0.7 hectares = 1.73 acres.

[40] Guatemala, Direccion General de Estadistica, Censo Agropecuario: 1950, Agricultura, Vol. I, (Guatemala City: August, 1954), pp. 187-191.

and total seed requirements amounted to 37,000 quintales. Spoilage was generally low; in 1956 it amounted to less than two per cent of the total annual yield.

Horsebeans, garbanzos or chickpeas, and lentils were also produced, but their combined annual total for all years was small. Only 81,000 quintales of horsebeans were produced in 1950 and less than 1,300 quintales of garbanzos and lentils.

Green and Yellow Leafy Vegetables: There has been no information published concerning the production of green and yellow leafy vegetables. However, in 1950 less than 2,000 manzanas were utilized for the raising of these vegetables throughout the entire country.[41] This figure presumably refers to the area which was devoted solely to commercial production.

Corn: The corn crop averaged 9,343,000 quintales per year during the five years from 1950 to 1956.[42] The land harvested was 858,000 manzanas and 172,000 quintales were used for seed. Spoilage varied from as little as five per cent in the Central Highlands to as much as 30 per cent in the Pacific Coastal Zone. Very little information is available concerning the amount of corn used for feed. Corn available for human consumption in 1956 amounted to 1.9 quintales per person per year.

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[41] Ibid., pp. 203-204.

[42] Ibid., pp. 117-127.

Wheat. In the period 1950 to 1955 the wheat crop averaged 464,000 quintales per year.[43] The 52,000 manzanas planted each year required that 71,000 quintales of wheat be saved from the preceding year's crop for seed. Spoilage was less than three per cent; very little was fed to animals. After correcting for seed requirements and spoilage, 379,000 quintales remained for human consumption, a figure which agrees fairly well with the reported quantity of home grown wheat that was milled. With an extraction rate of 71 per cent, the production of wheat flour was 269,000 quintales.

Rice: Rice production for 1950 is listed at 220,000 quintales.[44] Seed requirements for the next year were less than ten per cent of the total crop. The area harvested amounted to 12,000 manzanas. Losses of rice through spoilage and other causes were very low; and an estimated 197,000 quintales remained after all deducations for human consumption. One hundred twenty-eight thousand quintales of hulled rice were available after milling.

Sugar: Production of refined sugar averaged 791,000 quintales per year during the period 1950 to 1955. Corresponding data on the production of panela[45] was not available.

Roots: Root crops harvested for consumption were principally potatoes, yuca, and sweet potatoes.[46] No information was available on the

[43] Ibid., pp. 171-176.

[44] Ibid., pp. 157-163.

[45] Sugar cane is crudely processed into brown cakes (panela).

[46] Guatemala, Direccion General de Estadistica, Censo Agropecuario: 1950, Agricultura, op. cit., pp. 247-248, 263-264, 270-271, 272-274, 282.

duction of sweet potatoes. In 1956 the potato crop was 202,000 quintales. The harvested area was only 4,700 manzanas, but 80,000 quintales were required for seed. Spoilage was high and estimated to be as much as 25 per cent of the total crop. Less than 100,000 quintales remained for human consumption.

In 1950 the production of yuca was 73,000 quintales. More recent figures are not available.

Fruits (Excluding Bananas and Plaintains): Statistics on fruit production are by no means complete. Even though 24 different kinds of fruit were eaten by the population, quantitative information was available for only seven. Since very little fruit was grown in closed orchards, it was extremely difficult to obtain reliable data on the number of trees and on production figures.

There were picked, in 1950, 2,371,000 pineapples, 156 million oranges, 58 million peaches, 4,800 quintales of apples, 2,500 quintales of plums, and 64 quintales of grapes.[47] Spoilage was approximately 20 per cent of the total crop.

The seventh fruit, whose production is perhaps more important than the others since it is the chief source of fat in the diet of the Indians, is the avocado. In 1950 there were 61,000 trees producing an estimated 90 million avocados.[48]

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[47] Ibid., pp. 195-201.

[48] Ibid., pp. 233-240.

Bananas and Plantains: Production of bananas for 1950 was 6,039,000 stems (or stalks);[49] 4,974,000 stalks were exported leaving less than one million stems of bananas for local consumption. The 1956 figures list 6,297,000 stems. Of these, 5,118,000 stems were exported, leaving 1,179,000 stalks for the local market. Spoilage amounted to 20 per cent and waste another 15 per cent. There remained, therefore, for human consumption about 470,000 quintales.

Recent figures for plaintain production were not available. However, for 1950, production amounted to 638,000 stalks.[50] After deductions for spoilage and waste, there remained 130,000 quintales of edible fruit.

Evaluation of Data on Production: These observations on food production in Guatemala are summarized in Table 1. The gross production figures for 1951-1955 have been listed in column 2 and in the third column, the net amounts of the various foodstuffs available to the consumer. In order to evaluate the adequacy of the net production of food, the minimal requirements of the total population of Guatemala are itemized in column 1. It is evident that there was a deficit in every instance except sugar, for which 162 per cent of the requirement was met. In all other cases the percentages were less than 100. In the case of corn the figure was 86 per cent; meat, 50; and for all others, one-third or less.

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[49] Ibid., pp. 261-262.

[50] Ibid., pp. 211-220.

Food Consumption. The people of Guatemala derive most of their food from cereals (Table 2). In fact the consumption of cereal is higher than in any other Latin American country for which data are available. Furthermore, when compared to other representative Latin American countries (Table 2), the intake of protein-rich foods, fruits, and vegetables is low. In order to evaluate the nutritional adequacy of the estimates of food consumption, the next step is to consider the way this food is prepared and eaten.

Methods of Food Preparation: Corn, the principal food of the country, appears in the diet at least three times a day in the form of tortillas, tamales, or atole. These are prepared by soaking dry corn in cold water containing "Cal" (calcium oxide). After boiling and several washings, the corn is ground to a dough called "masa." The dough for tortillas is shaped into thin, flat, unseasoned cakes which are cooked rapidly on a pottery or metal plate. For tamales, the "masa" is wrapped in corn leaves and steamed. Atole is a hot beverage and is prepared by simply mixing the ground corn in boiling water. Tortillas are the daily bread for all Indian families, rich or poor, and as such are indispensable. Wheat and rice represent only a small fraction of the cereal foods consumed by Indians. These are predominately used by Ladinos.

Beans, especially black kidney varieties from bush and vine, are second in importance to corn in the diet. Preparation is simple. They are cooked for three or four hours in an earthenware pot. Salt is added and often an onion plant or mint leaf. The Ladino prefers to fry the boiled beans afterwards in fat, generally lard.

TABLE 1

COMPARISON OF FOOD PRODUCTION IN GUATEMALA AGAINST THE MINIMUM FOOD REQUIREMENTS[a]

Foodstuff	Requirements Total Population[1]	Production (1951-55 Average)	Available to Consumer	Surplus or Deficit	Per cent of requirements Met
Milk (1,000 liters)	147,000	40,000	38,000	-109,000	26
Eggs (1,000 dozens)	23,240	10,000	8,000	- 15,240	34
Meat (1,000 quintales)	1,980	1,097	988	- 992	50
Legumes[2]	1,532	595	528	- 1,004	35
Vegetables, Green and Leafy[2]	2,428	N.A.[3]	N.A.	N.A.	N.A.
Vegetables, Others[2]	3,192	N A.	N.A.	N. A.	N.A.
Fruits[2]	2,044	853	683	1,361	36
Bananas and Plantains[2]	1,691	3,980	600	- 1,091	35
Roots and Tubers[2]	1,338	275	156	- 1,182	12
Corn[2]	7,361	9,343	6,368	- 993	86
Wheat[2]	1,016	464	379	- 637	37
Rice[2]	991	219	128	- 863	13
Fats and Oils[2]	353	102	102	- 251	error 162 ~ 32%
Sugar[2]	1,193	1,991	1,931	+ 738	162

[a]Source: INGAP; Klein and Saks, Washington, D.C.; Department of Statistics, Guatemala.

KEY:

(1) Population as of July, 1955: 3,268,000
(2) Amount in quintals (1 quintal = 101.46 lbs.)
(3) Not available

TABLE 2

AVERAGE FOOD SUPPLIES AVAILABLE FOR HUMAN CONSUMPTION IN SOME LATIN AMERICAN COUNTRIES[a]

(kg/caput/year)

Country	Year	Cereals	Starchy Roots	Sugar	Pulses	Fruits	Vege-tables	Meat	Milk	Eggs	Fish	Fats and Oils
Guatemala	1953	157	2	24	10	--	--	14	35	1	-	3
Argentina	1955	120	80	30	4	94	52	110	190	7	2	16
Uruguay	1954	98	67	29	2	66	37	96	185	7	2	16
Mexico	1952	144	7	33	15	56	23	19	67	2	3	9
El Salvador	1953	146	3	20	11	--	--	10	--	-	1	4
Honduras	1954	113	8	28	11	--	12	13	60	5	-	4

[a]Source: Fourth Latin American Nutrition Conference, 1957, United Nations World Health Organization, Guatemala City, Guatemala.

A considerable part of the population has to rely on beans as the sole accompaniment to tortillas. For variety, red and white beans are occasionally eaten, but the black or "frijol negro" is by far the most popular. They are cooked fresh each day and are eaten at breakfast, lunch, and dinner.

While the diet is basically one of corn and beans, other foods are eaten. The consumption of vegetables is low, but when possible they are added to the diet. One of the most popular vegetables is a small variety of the red tomato. It is ground with chile pepper and onion plant to become "chermol," a sauce used for flavoring tortillas, meat soups, boiled greens, etc. Among the poorer Indians, a wild green, "macuy," is used extensively. Vegetables are cooked to mark special occasions, such as the unexpected visit of a guest. The majority of the population does not, however, feel that a vegetable dish is an adequate substitute for meat or even for beans.

Coffee is the common drink. It is drunk at every meal and is sweetened with "panela," with which it is boiled. Nearly all of the sugar consumed in Guatemala, especially that used by the Indians, is "panela," a crude, dark brown sugar sold mainly in the form of hardened block squares.

Although all foods are modified by cooking, Guatemalan cooking methods are not unduly destructive of the various nutrients. Vegetables are not cooked long, and the popular "chermol" sauce of tomato, onion, and chile, is often eaten raw. When vegetables, such as greens, form a separate dish, the cooking water is not discarded. Vegetables ordinarily go from the field to the pot within 24 hours, so that nutrient losses due to storage are almost completely lacking.

Daily Pattern of Meals: The pattern is three meals a day. Meals are eaten in the seclusion of one's house and never out of doors.

Breakfast usually consists of day old tortillas, reheated on the fire, and sweet black coffee. If available, a sauce ("chermol") is used to flavor the tortillas. Reheated beans from the preceding dinner meal are also a common breakfast dish.

The midday meal is the main meal of the day for a great part of the population. The tortilla supply is prepared at this time. If meat is purchased once in a day, it is consumed at the noontime meal. It is commonly prepared as a soup or "caldo de res," with chile, onions, tomatoes, carrots, and coriander leaves. Cabbage, potatoes, and "chermol" are also added and rice is occasionally used to thicken the mixture. Meat without bone is often roasted over the fire. Coffee may be omitted when there is a liquid dish, such as soup

The night meal, like breakfast, consists mainly of reheated tortillas and "chermol" sauce, left-over beans, and sweet black coffee.

Distribution of Daily Food Among Members of the Family: It is not uncommon for a child to be breast-fed until two or three years of age, providing the mother does not become pregnant again. When pregnancy does occur, the mother feeds the young infant a hot, liquid substance made from ground corn and water ("atole").

The tortilla is usually given to a child to taste at approximately one year of age, or when the child has teeth with which to chew it. Frequently, the tortilla is first softened by dipping it into a bean gravy or broth before

being fed to the infant.

The "atoles" and boiled vegetables which constitute the diet of the newly weaned child, are not prepared at each daily meal. The average Indian mother is kept too busy with her household tasks, other children, or by working in the fields, to be able to spend enough time each day to prepare a special meal. The two-year old child is fed tortillas, plain or dipped in bean gravy. Children under three are usually not given whole cooked beans, but some mothers will either mash and strain or grind the beans and then feed them to the child.

Eggs, though considered nourishing, are too expensive to be used regularly. Meat is thought to be indigestible for children. Moreover, most mothers think of meat broth ("caldo de carne") as a good nourishment for a young infant or child. Fresh fruit, however, is generally regarded as indigestible.

In the second year, therefore, the child is fed foods which will later form the majority of its adult diet. Although he does not eat them cooked or served in the same manner as the adult, the child does have the broth of the meat soup or beans and plain boiled vegetables.

By the time a child has reached the age of five or six, he is allowed to eat all types of foods that the mother prepares; but he is not free to help himself to any amount of the various dishes put before the family. The mother serves the child the quantity of tortillas, beans, or vegetables, which she deems adequate. The child may ask for a second helping and will get it if there is sufficient to go around. Women serve their husbands first, then the children, and finally themselves. It is very unusual to see either children or adults eating between meals, and the amount of food consumed

as snacks is negligible.

Other Cultural Attitudes: The mind of the Guatemalan Indian is filled with animisms of his Mayan heritage. He believes that animals talk, plants have emotions, people can change into animals, it is possible for a hoe to work alone, etc. Superstitions are not left to a few old people; they are part of the life of the community, shared by old and young alike. They are premises upon which the people commonly reason and the considerations which shape action.

Sorcery practiced in Guatemala relies on spells and is feared by Ladinos as well as Indians. One of the principal ways by which a spell is cast is for a person with special evil powers to light candles and call upon evil spirits to harm a specific individual. The Indian believes that there is no way to determine if an illness is caused by sorcery. He believes that all means to cure an illness should be tried, in hopes one of them proves to be effective.

There is a widespread belief that worms are one of the chief causes of severe illnesses among children. Opinions differ as to whether children are born with worms, or whether they acquire worms within the first few weeks of life. There exists a whole folklore of beliefs about the specific foods which cause worms to lie dormant or become active. If a child shows any of the varied symptoms due to the presence of parasites, meat is withdrawn from the diet. Many mothers believe that cow's milk causes parasites to become active and deprive their children of this food.

A traditional cure for worms is purging. The gastro-intestinal tract of the child is evacuated either by feeding him a great deal of garlic and herbs or by administering an enema prepared from a soapy solution or from sugared or salted water.

Children suffering or recovering from an illness, especially diarrhea, are likely to become extremely malnourished. In the case of diarrhea, it is is believed that the child has eaten some bad food and purgatives are administered. In addition, the child is fed a very light diet of gruels made from water and corn tortillas, and black coffee. The longer a child takes to recover, the longer this inadequate diet is maintained.

Dietary Acculturation: The Indian basically maintains traditional food habits and tends to exclude from his diet such foods as white bread, refined sugar, lard, and rice. He has, however, adopted coffee and "panela." The Ladino, on the other hand, prefers the non-Indian foods and uses lard, white bread, refined white sugar, rice, and eggs.

Minimum Adequate Diet: The facts presented to this point overwhelmingly demonstrate that the daily diet of the Guatemalan consists largely of tortillas, beans, and sweetened black coffee. Meat, vegetables, and fruit are eaten only occasionally and in small quantities. Judgments regarding the nutritional adequacy of such diet must be more or less arbitrary, for the food habits of the Guatemalan vary widely depending on whether the family is rural or urban, Ladino or Indian. INCAP has prepared two minimum adequate diets, one rural (Table 3) and other urban

(Table 4). These diets, based on the local food habits, are designed to meet dietary standards considered adequate for the two population groups.[51] When a comparison is made between the actual food consumption, as determined by INCAP dietary surveys, and these minimum adequate diets, it is found that neither the food consumed by the urban or by the rural population comes near meeting the minimum dietary requirements.

In the urban diet only tomato, coffee, and sugar consumption either exceeded or met the minimum requirements established by INCAP. Corn, in the form of tortillas, was 20 grams short of the minimum each day and bread was deficient by 26 grams; such foodstuffs as eggs, cheese, and milk were consumed in amounts considerably below established requirements.

The per capita consumption of food by the rural population, except for coffee, sugar, and tomato, was even less than the actual urban consumption. Corn, beans, rice, and vegetables were deficient. The amount of meat consumed was less than 50 per cent of the minimum dietary requirements.

Nutrients Supplied by the Daily Diet. In order to evaluate the preceding data on food production and consumption, one must make a reasonable estimate of the intake of the nutrients contained in these foods. To judge whether or not the intake of the several nutrients is adequate, one must have a standard. Such standards have been prepared by INCAP, World Health Organization, and Food and Agriculture Organization of the United Nations. The standards

[51] "Diets for the computation of minimum food costs in Guatemala," Turrialba, June 18, 1952, p. 10.

TABLE 3

MINIMUM DIET AS COMPARED TO ACTUAL FOOD CONSUMPTION BY A RURAL INDIVIDUAL[a]
gm/day

Food Item	Dietary Requirements per Person	Actual Consumption per Person
Meat	55	26
Eggs	7	3.4
Cheese	11	0
Milk	120	3.2
Beans	57	58
Rice	19	3.3
Corn	345	318
Bread	15	1.7
Lard	8.3	1
Panela (crude sugar)	54	37
Tomato	11	13
Vegetables	84	50
Bananas	13	6
Other fruits	12	5
Coffee	11	12
Salt	11	9

[a]Source: INCAP.

TABLE 4

MINIMUM DIET AS COMPARED TO ACTUAL FOOD CONSUMPTION BY AN URBAN INDIVIDUAL[a]
gm/day

Food Item	Dietary Requirements per Person	Actual Consumption per Person
Meat	60	49
Eggs	8	4.3
Cheese	13	2
Milk	114	38
Beans	92	56
Rice	92	12
Corn	325	305
Bread	72	47
Lard	13	6
Sugar	16	58
Tomato	13	13
Onion	10	8
Vegetables	75	27
Bananas	150	12
Other fruits	28	10
Coffee	13	16
Salt	13	11

[a]Source: INCAP.

to be used in this report are listed in Table 5.[52,53]

Calories: The average calorie intake of the individual in Guatemala is 2,190 (Table 6). In relation to other representative Latin American countries, this intake ranks very low. Moreover 60 per cent of these calories are obtained from corn (Table 7). Guatemala ranks first among these same Latin American countries in the per capita consumption of corn.

Protein: Since two-thirds of the total calories comes from corn and there is a very low intake of milk, meat, and eggs, it is not surprising to find that the total intake of protein is reasonable while the intake of animal protein is most inadequate (Table 6). In Guatemala the intake of total protein is just a few grams less than the recommended requirements (Table 5). On the other hand, the intake of animal protein, nine grams, is far short of the minimum 25 gram daily requirement.[54]

Dietary surveys undertaken by INCAP reveal that protein consumption varies from one area to another and also within the various economic groups

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[52] Nevin S. Scrimshaw et al., "Epidemiology and prevention of severe protein malnutrition (Kwashiorkor) in Central America," American Journal of Public Health, Vol. XXXXVII, No. I, January, 1957, pp. 53-62.

[53] Instituto de Nutrition de Centro America y Panama, "Recomendaciones nutricionales diarias para las poblaciones de Centro America y Panama", Suplemento No. 2 del Boletin de la Oficina Sanitaria Panamericana, Publicaciones Cientificas del Instituto de Nutrician de Centro America y Panama, November, 1955, p. 225.

[54] Josiah Macy Jr. Foundation, Human Protein Requirements and Their Fulfillment in Practice, Proceedings of a Conference in Princeton, United States, 1955, (New York: 1957), pp. 117-118.

TABLE 5

NUTRITIONAL RECOMMENDATIONS FOR DIETARY ALLOWANCES FOR THE POPULATIONS OF CENTRAL AMERICA AND PANAMA[a]

Sex, Age, Weight, and Activity	Calories	Total Protein gm	Calcium gm	Iron mg	Vit. A mg	Thiamine mg	Riboflavin mg	Niacin mg	Ascorbic Acid mg
Male, young adult (25 yrs.)									
Moderate physical activity	2,700	55	0.7	10	1.3	1.4	1.4	14	50
Rural physical activity	2,900	55	0.7	10	1.3	1.5	1.4	15	50
Female, young adult (25 yrs.)									
Moderate physical activity	2,000	50	0.7	10	1.3	1.0	1.2	10	45
Rural physical activity	2,500	50	0.7	10	1.3	1.2	1.2	12	45
Pregnant, 3rd month	2,500	75	1.3	14	1.6	1.2	1.8	12	65
Lactating	3,000	90	1.8	14	2.1	1.5	2.2	15	95
Children of both sexes									
From 6 to 12 months	110/kg	3.5/kg	0.9	6	0.4	0.5	0.8	5	20
From 1 to 3 years	1,100	40	1.0	7	0.6	0.6	1.0	6	25
From 4 to 6 years	1,500	50	1.0	8	0.8	0.8	1.2	8	35
From 7 to 9 years	1,900	60	1.0	10	1.0	1.0	1.5	10	40
Males from 10 to 12 years	2,400	70	1.2	12	1.1	1.2	1.8	12	50
Females from 10 to 12 years	2,200	70	1.2	12	1.1	1.1	1.8	11	50
Males from 13 to 15 years	3,000	85	1.4	15	1.3	1.5	2.1	15	60
Females from 13 to 15 years	2,500	80	1.3	15	1.3	1.2	2.0	12	50

[a]Source: INCAP.

TABLE 6

CALORIE AND PROTEIN CONTENT OF NATIONAL AVERAGE FOOD SUPPLIES IN SOME LATIN AMERICAN COUNTRIES[a]
(units/caput/day)

Country	Year	Total Calories	Total Protein (gm)	Animal Protein (gm)
Guatemala	1953	2,190	62	9
Argentina	1955	3,150	105	61
Uruguay	1954	2,810	92	57
Mexico	1952	2,270	65	15
El Salvador	1953	1,910	49	4
Honduras	1954	2,220	55	12

[a]Source: Fourth Latin American Nutrition Conference, 1957, United Nations World Health Organization, Guatemala City, Guatemala.

of the population [55] In Guatemala, the distribution of high protein foods is influenced by market prices and a considerable part of the population cannot afford to buy milk or meat, except occasionally and then only in small quantities.

In many countries the deficiency in animal protein is offset to some degree by the relatively high consumption of vegetable foods rich in protein, such as pulses. Unfortunately, such is not the case in Guatemala. The amounts of these foods consumed are not sufficient to supplement the proteins

[55]Marina Flores et al., "Estudios de habitos dieteticos en poblaciones de Guatemala," Boletin de la Oficina Sanitaria Panamericana, June, 1956, p. 504.

contained in staple cereals and roots, particularly when these are corn and yuca.

Eight amino acids (tryptophan, phenylalanine, lysine, threonine, methionine, leucine, isoleucine, valine) are necessary dietary components for human well being.[56] Does the customary diet of the average Guatemalan supply a sufficient amount of these substances? Since the essential amino

TABLE 7

CALORIES FROM CORN IN SOME LATIN AMERICAN COUNTRIES[a]

Country	Year	Daily Calories From Corn	Per Cent of Total Calories
Guatemala	1953	1,329	60.6
Argentina	1955	47	1.5
Uruguay	1954	32	1.1
Mexico	1952	1,103	48.5
El Salvador	1953	808	42.3
Honduras	1954	943	42.5

[a]Source: Fourth Latin American Nutrition Conference, 1957, United Nations World Health Organization, Guatemala City, Guatemala.

[56]Josiah Macy Jr. Foundation, op. cit., p. 117.

acids are supplied chiefly from animal sources and since in the Guatemalan diet corn, a food deficient or lacking in these essential amino acids, supplies more than 40 per cent of the total protein in the Guatemalan diet, it is not surprising that the daily diet is deficient in these essential nutrients.[57] Furthermore, because of its low biological value, only 30 to 80 per cent of the protein in the corn can be utilized for growth and maintenance of body tissues. For a large portion of the population this means that considerably less than half of the amino acid nitrogen contained in corn can be used for protein synthesis in the body.[58]

Calcium: While foodstuffs supply only very small amounts of calcium,[59] approximately 95 per cent of the total is obtained from vegetable sources. Beans are one of the main sources of food calcium. Whole corn, not a calcium-rich food, is important primarily because of the quantity in which it is used. Green leafy vegetables provide a small additional amount of calcium.

The deficiency of food calcium in the Indian's diet is compensated by the use of lime in the preparation of corn for grinding and eventual consumption

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[57] Margaret L. Moen et al., "Estudios de habitos dieteticos en Poblaciones de Guatemala," Suplemento No. I de Boletin de la Oficina Sanitaria Panamericana, May, 1953, p. 37.

[58] Ricardo Bressani et al., "El valor nutritivo de las variedades de maiz cultivadas en Centro America," Boletin de la Oficina Sanitaria Panamericana, November, 1955, pp. 195-199.

[59] Francisco Aguirre et al., "Nutritive Value of Central American Corns," Food Research, Vol. XVIII, October, 1953, pp. 268-273.

in the form of tortillas This practice of artificial enrichment supples an estimated 75 per cent of the total calcium intake; and together with the naturally occurring food calcium, does meet the minimum requirements.

Iron. Iron, supplied by the diet, is considered to be adequate.[60] The major part comes from the use of whole corn in which the germ and bran portions are retained. Other sources of iron are the legumes (mainly beans), sugar, and beef.

Niacin: The niacin content of the diet is also considered adequate in most cases. Whole corn, due to the quantity used, is the main niacin source.[61]

Riboflavin. Riboflavin, like food calcium, averages less than half of the recommended amount. This low intake is to be expected in a diet deficient in milk and milk products. As mentioned previously, eggs are used primarily for sale to wealthy individuals, and because of their cost enter the diet of the majority in very limited amounts. Corn, legumes, roots and tubers, green vegetables, and fruits are the main sources of riboflavin in the diet.[62]

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[60] Miquel Guzman et al., "Serum Ascorbic Acid, Vitamin A, Carotene, Vitamin E, Riboflavin, and Alkaline Phosphatase Values in Central American School Children," Boletin de la Oficina Sanitaria Pan-Americana, May, 1953, p. 21.

[61] Ibid.

[62] Ibid.

Ascorbic Acid: Ascorbic acid intake is low; often times less than 40 per cent of the recommended value. This is related primarily to the small consumption of fresh vegetables and fruits. Peppers, tomatoes, and coriander leaves and green mangoes and "Jacotes" (cashew apples) are the vegetable and fruit sources.[63]

Vitamin A: Vitamin A is also considered to be deficient in the diet. This deficiency, like that of riboflavin, results from the small consumption of animal products, green leafy vegetables, and fruits. Vegetables, principally tomatoes, chile peppers, and wild greens, provide the majority of Vitamin A in the diet.

Thiamine: The thiamine supplied by the diet is considered to be adequate, with whole corn and beans being the chief sources.

Comment. The preceding data bring out three major points, all of which clearly indicate that the nutritional status of the Guatemalan is not satisfactory. In the first place, it was shown that the total agricultural output was not increasing annually at the same rate as the population. This fact suggested that even if the Guatemalan could afford to buy an adequate diet, it would be very difficult to do so. In the second place, it was demonstrated that with the sole exception of sugar, food production of individual foodstuffs fell far short of the minimum requirements (Table 1). This fact supports the preceding inference that it is very difficult, and beyond the purse of most, to obtain an adequate diet. Additional evidence was provided by the

facts that the actual food consumed by urban and rural families was below minimum standards (Tables 3 and 4). Finally it was shown that the diet of the average Guatemalan was characterized by a high carbohydrate, low fat, and low protein content. Often times as much as 75 per cent of the total calories was derived from carbohydrates and only small amounts of protein came from animal sources. By analysis the diet was found to provide adequate amounts of calcium, iron, niacin and thiamine. The intake of vitamin A, riboflavin, and ascorbic acid, however, did not meet the recommended requirements. These facts allow the prediction that there should be a considerable incidence of clinical protein malnutrition among the population.

CHAPTER III

MEDICAL ASPECTS OF PROTEIN MALNUTRITION AND KWASHIORKOR

Historical Summary. Scientific investigation of malnutrition and kwashiorkor did not begin in Latin America until early in the twentieth century. One of the earliest works that provided the beginnings of the objective description of kwashiorkor was written by Correa.[64] In 1908 he published a clinical study on a disease in Yucatan known as "culebrilla." The name, "culebrilla," depicted a peculiar appearance of the skin which was characterized by serpentine areas of hyper- and hypo-pigmentation. The disease was found mainly in young children, and it was marked by diarrhea, skin lesions, and edema of the legs and feet. Correa thought that "culebrilla" was in some way related to nutrition or to what was then called "chronic gastro-intestinal catarrh."

For four decades the work in Latin America remained isolated and unrelated to the research carried out in other parts of the world, especially in Africa and Asia In 1934 Carrillo recognized the deficiency origin of the syndrome and linked it to vitamin shortage.[65] In 1935 Castellanos described in Cuba, a condition distinguished by edema and pigmentary and exfoliative skin changes, which he called "sindrome pelagroide beri-berico."[66] In the

[64] J. Patron Correa, "Que es la Culebrilla," Revista Medica De Yucatan, Vol. III, No. 6, May, 1908, p. 89.

[65] Gil A. Cirrillo, "Manifestaciones raras de avitaminosis en las ninos De Yucatan," Revista Medica De Yucatan, Vol. XVII, June, 1934, p. 467.

[66] A. Castellanos, "Contribucion al estudio clinico de la avitaminosis B en Cuba. El Sindrome Pelagroide Beriberico," Revista Cubana de Pediatria, Vol. VII, October, 1935, p. 5.

same year Coelho and Goens[67] described a similar condition which they identified as a new disease and an important cause of infantile mortality in El Salvador.

In 1937 Castellanos[68] concluded that "pelagroide beri-berico" was very similar to the syndromes described by Correo and Carriloo. In the following year Cofino and Klee[69] summarized the current knowledge of this disease and concluded from their own investigations conducted in Guatemala that the edema arose as the result of hypoproteinemia. At this same time Pina and Rotter[70] attributed the nutritional edema so prevalent among children in Cuba to an avitaminosis (so-called "avitaminotic edema").

Between 1939 and 1944, similar syndromes were observed in Venezuela, by Franco[71] and in Honduras, by Vidal[72]; in Columbia, by

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[67] Rosales A. Goens, "Contribucion al estudio de las caquezias hidricas infantiles del tropics," Informe presentado a II Contreso Medico Centroamericano y de Panama (Costa Rica: 1935).

[68] A. Castellanos, "Pelagroide Beri-Berico," Vida Nueva, Vol. XXXX, January, 1937, p. 199.

[69] Ubico E. Cofino and Arguedas Klee, "Contribucion al estudio de ciertos edemas de la infancia (Sindrome debido a carencia alimenticia multiple)," Informe presentado a V. Congreso Medico Centroamericano y de Panama (San Salvador: 1938).

[70] Chavarria A. Pena and W. Rotter, "Edema avitaminosico de la infancia," Revista Medica Latinoamericano, Vol. XXIII, June, 1938, p. 77.

[71] M. Franco, "Los Sindromes Policarenciales" (Unpublished Doctors' thesis, University of Venezuela, 1939), p. 35.

[72] A. Vidal, "Avitaminosis compleja infantil," Revista Medica Hondurena, Vol. X, November, 1939, p. 243.

Valencia[73], and in Chile, by Scroggie[74]; again in Columbia, by Umana[75], in Uruguay, by Guerra and Peluffo[76], and in Mexico, by Torroella[77]; again in Costa Rica, by Pina, Saenz-Herrera, and Casseres.[78]

By 1944 numerous papers dealing with all aspects of the syndrome began to appear in Latin American literature. There was evidence that although multiple nutritional deficiencies were still considered as responsible for the syndromes, special emphasis began to be placed on the importance of protein deficiency. Flores[79], in 1944, published a most comprehensive and complete study of the clinical features, etiology, and therapy of the syndromes in Guatemala. After Flores, studies of the clinical, etiological, pathological, and socio-medical aspects of the diseases were made by Maghalhaes in Brazil[80, 81]; Zubilaga and

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[73] G Valencia, "Desnutricion en el lactante mayor (Destrofia Policarencial), Central de publicaciones Santiago, 1941, p. 76.

[74] A. Scroggie, "Sindromes carenciales en la infancia," Revista Chilena de Pediatrica, Vol. IV, June, 1941, p. 247.

[75] Torres C. Umana. "Edema distrofico," Revista Colombiana de Pediatria y Puericultura, Vol. V, July, 1942, p. 472.

[76] Gianelli C. Guerra and E. Peluffo, "Sobre una dermatosis especifica en la distrofia fearinacea," Archivos de Pediatria del Uruguay, Vol. XIII, 1942, p. 402.

[77] M. A. Torroella, "Sindrome hipoproteico-avitaminosico," Revista Mexicana de Pediatria, Vol. XII, 1942, p. 144.

[78] Chavarria A. Pena, C. Saenz-Herrera, and C. Casseres, "Sindromes policarenciales en Costa Rica," Revista Medica de Costa Rica, Vol. XI, 1944, p. 49.

[79] Neri Flores, "Carencias nutritivas (Sindrome de policarencia en la infancia)," Facultad de Medicina (Guatemala: 1944), p. 117.

[80] G Carvalho Magalhaes, "Distrofia pluricarencial hidropigencia," Journal de Pediatria de Rio de Janeiro, Vol. XI, 1945, p. 395.

[81] _____, "Contribucao Ao tratamento de distropia pluricarencial hidropigencia," Ibid., September, 1947, p. 245.

Barrera[82] and Oropeza[83] in Venezuela; Prado[84], Pagola[85], Maranda[86], and Gomez[87] in Mexico; and Scroggie in Chile[88]. The paper published by Pina, Saenz-Herrera, and Cordero[89] in 1948 summarized a two-year study of the syndromes in Costa Rica. Considerable emphasis was placed on such factors as economic and social conditions, dietary habits, and incidence of kwashiorkor.

In 1950 Meneghello[90] published what has come to be one of the most important research studies yet carried out. He established a parallel

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[82] A. Zubilaga and G. Barrera, "Sindromes carenciales en la infancia," Primeras Jornadad Venezalanas de Puericultura y Pediatria, Vol. IV, 1945, p. 203.

[83] P. Oropeza, "Las estados distroficos de la segunda infancia," Archivos Venezalanas de Puericultura y Pediatria, Vol. VIII, June, 1946, p. 1570.

[84] Vertiz A. Prado, "Desnutricion por carencia proteica," Revista Mexicana de Pediatria, Vol. XV, 1946, p. 277.

[85] J. Pagola, "Los estados carenciales en Mexico. Analisis de 500 ninos avitaminosicos," Boletin Medico del Hospital Infantil, Vol. V, 1947, p. 577

[86] F Miranda, "Nutrition and endocrinology with special reference to the nutrition of Mexican Indians," Journal of the American Medical Association, Vol. XXXVI, 1948, p. 592.

[87] F. Gomez et al., "Desnutricion de tereer grado," Boletin Medico del Hospital Infantil, 1952, p. 63.

[88] A. Scroggie, "Sindrome policarencial en la infancia," Revista Chilena de Pediatria, Vol. XX, 1946, p. 945.

[89] Chavarria A. Pena, C. Saenz-Herrera, and Carvajal Cordero, "Sindrome policarencial de la infancia," Revista Medica de Costa Rica, Junio, 1948, p. 210.

[90] J. Meneghello et al., "Liver steatosis in undernourished Chilean Children," American Journal of Diseases of Children, Vol. CXXX, July, 1950, p 889

between kwashiorkor as observed in Latin America with similar conditions described in other parts of the world. Autret and Behar[91], in 1954, definitely established the relationship of the syndrome in Central America to that of kwashiorkor in Africa. This publication was largely responsible for directing the attention of investigators at INCAP to a study of kwashiorkor.

Since 1949 INCAP has been the outstanding participant in the research on nutritional problems in Latin America. Its initial activities involved studies of the dietary habits, nutritional deficiencies, and composition of local foods. In1954 investigations were begun to gain a complete understanding of kwashiorkor in Central America, as well as its prevention.[92,93]

Terminology. It is now generally recognized that the various clinical manifestations of protein malnutrition and kwashiorkor throughout the world are all due to the same fundamental nutritional cause. It is evident that no one name for the syndrome has found acceptance in all countries. When the clinical manifestations, as seen in one region, are compared with those observed in another region, differences of degree, rather than kind, can be discerned. Thus, in one area, the physician is impressed by one group of symptoms, while in another area, he is impressed by a different

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[91] Marvel Autret and Moise Behar, Sindrome Policarencial Infantil (Kwashiorkor) and its Prevention in Central America, Food and Agriculture Organization of the United Nations, No. 13, (Rome: 1954), pp. 5-17.

[92] Nevin S. Scrimshaw et al., "Vegetable Protein Mixtures for the feeding of infants and young children," XIII Annual Protein Conference (New Brunswick: Rutgers University Press, 1957) pp. 28-46.

[93] Publicaciones Cientifacas (Guatemala: Instituto de Nutricion de Centro America y Panama, Junio, 1957), pp. 1-55.

group. This regional variability, particularly in the case of earlier researchers, caused them to identify the locally occurring conditions by a variety of names, first, which emphasized one or another clinical feature and, second, which represented the physician's idea regarding etiology (Table 8). For example, among those emphasizing the clinical features are "nutritional edema," "nutritional dystrophy," "edematous cachexia," etc. Etiological concepts, now discarded, such as "mehlnahrschaden," represented a phase in the evolution of knowledge in the understanding of the disease. These terms have all been discarded. It is now apparent that the regional differences are probably due to inequalities in the relative degree of deficiency of one or another of the nutrients responsible for this syndrome.

The name kwashiorkor is an African word describing an existing state of affairs. Early workers interpreted the word as referring to a dyspigmentation of the hair and skin. Unfortunately the translation "red boy" has gained widespread acceptance. The word kwashiorkor is from the language of the Ga, a native tribe living near the coast of Ghana. "Kwashi" means first and "orkor" second. It was derived from the observed fact that an infant usually fared well while breast-fed and continued to do so until the mother became pregnant again.

Although etymologically kwashiorkor does not refer to protein deficiency either, useage has now associated it with that concept. Since 1908 Latin American researchers have used at least two dozen different names to describe syndromes which have the same basic clinical features as kwashiorkor. Today, just two terms, protein malnutrition and kwashiorkor,

TABLE 8

SYNONYMS FOR KWASHIORKOR USED IN LATIN AMERICA

Synomym	Date	Synonym	Date
Culebrilla	1908	Third-grade malnutrtion	1946
Edema disease	1927	Avitaminosis	1947
Nutritional edema	1929	Undernutrition	1948
Edematous cachexia	1935	Fatty liver disease	1948
Pellagroid beri-beri	1935	Pancreatic atrophy and fatty liver	1949
Avitaminotic edema	1938	Pellagra and hunger edema	1949
Multiple alimentary deficiency	1938	Wet marasmus	1950
Multiple deficiency syndrome	1939	Infantile pellagra	1951
Edema and hypoproteinanemia	1939	Fat disease of the liver	1952
Dystrophy	1942	Syndrome pluricarencial infantil	1953
Pellagra	1942		
Starch dystrophy	1942		
Dystrophic edema	1943		
Edematous multiple deficiency dystrophy	1945		

are acceptable to Latin American researchers. There has been the general desire among them to retain a name which has meaning in Spanish. Synonymous with kwashiorkor in every essential characteristic and in the preferred Spanish is "infantile pluricarencial sindrome" (I.P.S.). The Third Conference on Nutrition Problems in Latin America in 1953 recommended its usage.[94] Similarly, during its third session, the Joint FAO/WHO Expert Committee on Nutrition, supported the use of the name "protein malnutrition."[95] It has been used widely because it denotes a conceptual framework within which one can include a variety of conditions, ranging from retarded growth and maturation with slight impairment of general health to kwashiorkor in its severest stage.

[94] Report of the Commission on Endemic Goiter of the Third Conference on Problems of Nutrition in Latin America, (Caracus: October 19, 1953).

[95] Food and Agriculture Organization of the United Nations/World Health Organization Joint Expert Committee on Nutrition, Report on the 3rd Session (FAO Nutrition Meetings Report No. 7, November-December, 1952) (Rome: 1953).

Description of the Clinical Characteristics. Both the Indian and the Ladino believe that food is associated with nourishment and health. True, their conception of what is nutritious does not always coincide with accepted nutritional practices, but they do consider food as a source of energy and health. Unfortunately, as was seen in Tables 2 and 6, nutritional deficiencies are observed in the dietary intake of much of the Guatemalan population. The nutritional status of the mother influences her child's susceptibility to the syndromes.[96] Though the mother is suffering from dietary deficiencies, the child grows satisfactorily during the early months of breast feeding. However, the effects of these nutritional deficiencies upon the mother's milk cause an inadequacy which becomes apparent when the child is from six to eight months of age. It is at this time that the child's weight and growth generally fall below that of well nourished infants. Among Indians, mother's milk is practically the sole food received by the child up to ten months of age. Indian children are generally breast fed up to two years, occasionally two and a half years. Among Ladinos, mixed feeding begins at about ten months and total weaning takes place at about 18 months. But in spite of this difference, there is no difference in the onset of the syndromes.

When weaning occurs few special feeding practices are utilized. The child's diet, in most cases, contains a high proportion of carbohydrate and little or no protein of animal origin. This diet is especially deficient in protein-rich foods such as eggs and meat, for the Indian considers these items are improper and indigestible by the pre-school child. Thus,

[96] Mendez Castaneda et al., "Estudios nutricionales en un grupo de ninos guatemaltecos en las edades comprendidas del nacimiento a un mes," Informe presentado a Congreso Nacional de Medicina (Guatemala: 1952).

at a time when the requirement for these foods is especially high because of rapid growth and maturation it is not unexpected to find that development of the child is retarded. If the child is fortunate enough to survive the pre-school period, normal development and growth will resume when scohool age is reached, largely because the protein requirements are somewhat reduced and the cultural attitudes toward food for the child no longer hold.

Malnourished children are frequently subjected to other factors that may precipitate severe malnutrition. Exposed to poor hygenic conditions, the child is vulnerable to infection or parasitism, to which it has not yet developed sufficient immunity or resistance. One of the commonest in Guatemala is infectious diarrhea, which not only interferes with the child's absorption of nutrients, but increases his loss of body proteins.[97] It is then a common procedure for the mother to restrict further the child's diet and the young infant or child is given a starchy solution such as rice water or corn starch gruel which is grossly deficient in all essential nutrients. The situation is further aggravated by the use of strong purgatives administered by the mother who believes that worms cause the diarrhea.

Growth and Development: Over 85 per cent of all Guatemalan children are reported to be markedly retarded in height when compared to well

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[97] Dorothy Beck et al., "Studies on diarrheal diseases in Central America. I. Preliminary findings on cultural surveys of normal population groups in Guatemala," American Journal of Tropical Medicine and Hygiene, Vol. VI, No. I, January, 1957, pp. 62-71.

nourished children of the same age.[98-101] The report of Guzman and Munoz disclosed that the height increments during the first six months after birth closely paralleled the curve for Iowa standards.[102] During subsequent years, however, there was a progressive divergence with the net result that the mature Guatemalan was considerably shorter than his American counterpart.

There are still doubts concerning the appropriateness of utilizing the Iowa standards for comparison purposes, since Guatemalan, and particularly Indian children, might not have the same growth rate or potential as the group studies in Iowa. INCAP researchers observed that the degree of retardation is almost as marked in Costa Rican children of European origin as for Guatemalan children of Indian admixture. Although it has been difficult to determine the respective roles which race, nutrition, environmental elements, etc., play in retarding growth, it is thought that retardation is not due to racial causes alone.

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[98] Miquel Guzman and J. Antonio Munoz, "Reporte preliminar sobre pesos y estaturas en escolares de Guatemala," Revista del Colegio Medico de Guatemala, Vol. IV, October, 1953, p. 60.

[99] Nevin Scrimshaw and Miquel Guzman, "The effect of dietary supplementation and the administration of Vitamin B_{12} and Aureomycin on the growth of school children," Nutrition Symposium Series No. 7 (The National Vitamin Foundation, 1953), p. 101.

[100] Carlos Perez et al., "Clinicos nutricionales en poblaciones de el Salvador," Suplemento No. 2 del Boletin de la Oficina Sanitaria Panamericana, November, 1955, p. 22.

[101] J. M. Reverte and Carlos Perez, "Estudios clinicos nutricionales en poblaciones de Panama," Supplemento No. 2 del Boletin de la Oficina Sanitaria Panamericana, November, 1955, p. 27.

[102] H. C. Stuart and H. V. Meredith, "Use of body measurements in the school health program," American Journal of Public Health, Vol. XXXVI, 1946, p. 1365.

INCAP researchers examined and evaluated the skeletal maturation of large numbers of Guatemalan children and their results closely paralleled those obtained from inspection of the height and weight data.[103] Well nourished Guatemalan children followed the same bone maturation course as the American children used in establishing the standards. Indian and poor urban children coinicded closely with the standards only until one year of age. From one until four years of age, maturation lagged to such an extent that the net gain was only about one year in bone age. The result was that a child at school age averaged more than two years behind well nourished children in skeletal maturity.

Anorexia: Children suffering with kwashiorkor are frequently observed to have anorexia or a lack of appetite. This symptom may result from the general apathy of the child as well as from a failure in the digestive mechanism. It is difficult to treat and the degree of anorexia is often so severe that tube feeding is required. Occasionally the child will refuse all food new to him and will consume only tortillas and beans.

Diarrhea: Due to a variety of causes, diarrhea is a constant factor which has been reported to either precipitate or aggravate the syndrome.[104] Medical investigators found that diarrhea could not always be ascribed to dietary, infectious, or parasitic causes and concluded it was a clinical sign of the syndrome. It has been difficult to ascertain the cause of the diarrhea in a child with kwashiorkor, due to the lack of medical personnel

[103] Guzman, loc. cit.

[104] Carlos Perez, "Estudios sobre la edad osea en ninos Guatemaltecos," Revista del Colegio Medico de Guatemala, Vol. VI, October, 1956, pp. 44-47.

and facilities throughout the rural areas of Guatemala. Beck's investigations revealed that from five to 20 per cent of all children in rural villages were found to be infected with shigella.[105] From 1.3 to 3.6 per cent of the children suffered from clinical diarrhea in the course of any single week. It is concluded that diarrhea may either create an actual deficiency condition in a child who is already on the borderline of malnutrition, or cause the immediate appearance of kwashiorkor which the child was slowly developing.

Edema: One of the most important clinical signs of kwashiorkor in Guatemala is edema. Acute gastro-intestinal disturbances such as diarrhea and vomiting, may cause it to appear rather suddenly. Varied forms of edema are observable and the onset of edema is thought to mark a transition from the mild to the severe state of kwashiorkor.[106] Most often the edema is localized in the legs and feet (Figures 5, 6, and 7). Edema of the forearms and hands, as well as the face is common (Figure 8). The sign is frequently found in the genital and abdominal regions and edema of the pelvis and prepuce may be severe.[107]

Edema may appear in children who, because of vomiting and diarrhea, also display signs of dehydration (Figure 6). The most common signs of dehydration are dry mucous membranes, folding and wrinkling of the skin and sunken eyeballs.[108]

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[105] Beck, loc. cit.

[106] Autret and Bebar, op. cit., p. 15.

[107] H. C. Trowell, J. N. P. Davies, and R. F. A. Dean, Kwashiorkor (London. Edward Arnold Ltd., 1954), pp. 75-80.

[108] Autret and Behar, op. cit., pp. 14-16.

Figure 5

Edema in legs and feet of a boy with kwashiorkor. Note the skin lesions.

Figure 6.

Edema, prominent abdomen, and lesions on legs and arms.

Changes in the Skin, Mucous Membranes, Hair, and Nails: Skin: Pigmentary changes, such as hyperpigmentation, are commonly observed and the close resemblance of these alterations to those of pellagra caused early researchers to confuse the syndrome with other diseases. Hyperpigmentation occasionally causes the skin of a child to turn a dark grayish color.[109] More often the hyperpigmentation is irregularly distributed dark grey patches appearing first on the dorsal surface of the hands and

[109] Ibid., p. 16.

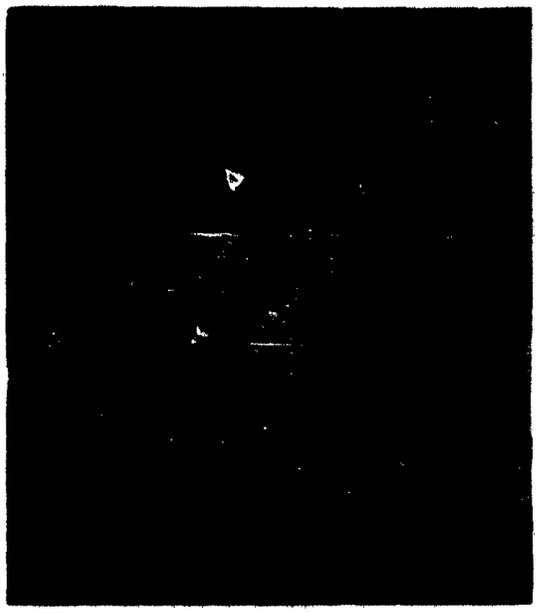

Figure 7

Prominent abdomen, edema of legs, and irritability in a three year old girl with pre-kwashiorkor.

feet and later on the extensor surface of the arms and legs, on the abdomen, and on the face. These patches are marked by irregularly shaped areas in which the skin is shiny and dry and has a cracked appearance.[110]

In the case of severe kwashiorkor, the areas of hyperpigmentation usually ulcerate after the skin peels (Figures 9 and 10). When the tissues on which such ulcerations appear are edematous, they exude a clear serous fluid. Such tissues readily become infected, leading to a more extensive and deeper ulceration (Figure 11).

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[110] Scrimshaw et al., "Nutritional problems of children in Central America and Panama," Pediatrics, Vol. XVI, September, 1955, p. 388.

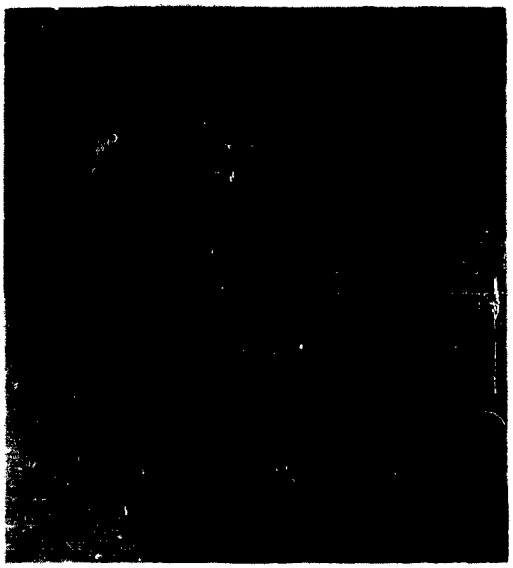


Figure 8.

Terminal case of kwashiorkor in a girl showing edema of the forearms, hands, and face. Note the cutaneous lesions with deep excoriations on the forearms and face and the irritability of the child.

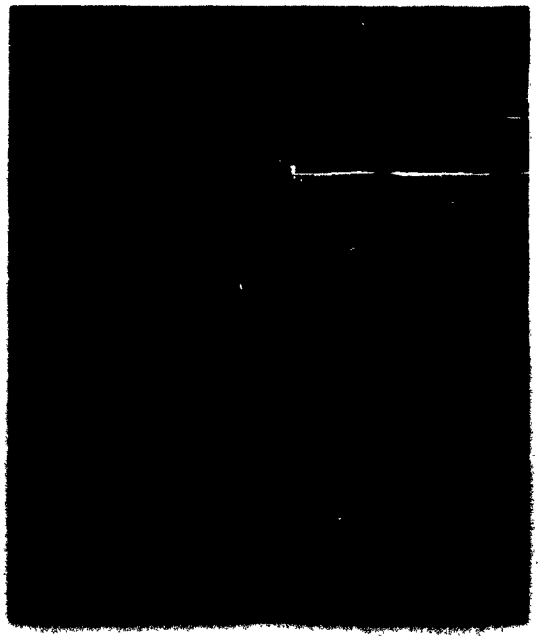


Figure 9.

Skin lesions, peeling of the skin, and general appearance of severe kwashiorkor in a girl $4\frac{1}{2}$ years of age.

Figure 10.

General appearance of kwashiorkor in $4\frac{1}{2}$ year old girl. Note skin lesions, peeling of the skin, edema, and changes of the hair.

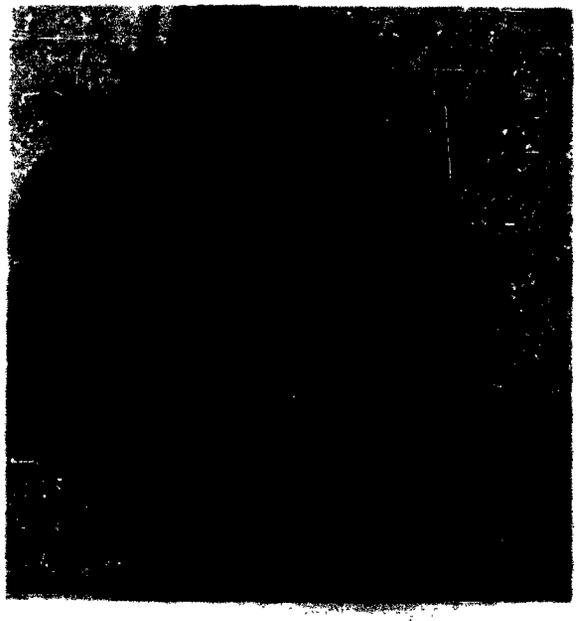


Figure 11.

Skin lesions, peeling of the skin, edema, and dyspigmentation of skin in girl, $4\frac{1}{2}$ years of age.

Keratinization of the skin is another common sign of kwashiorkor in Guatemala. It occurs quite frequently in cases of multiple deficiencies and is associated withpigmentary changes. The skin is usually dry, thickened, and wrinkled, especially on the shoulders. Dry or seborrhoeic desquamating lesions, found on the skin of the scalp, are responsible for the loss of hair. The hair becomes sparse and can be plucked out easily and without any pain.[111] Areas of baldness are very common and are located in the occipital region (Figures 10 and 12).

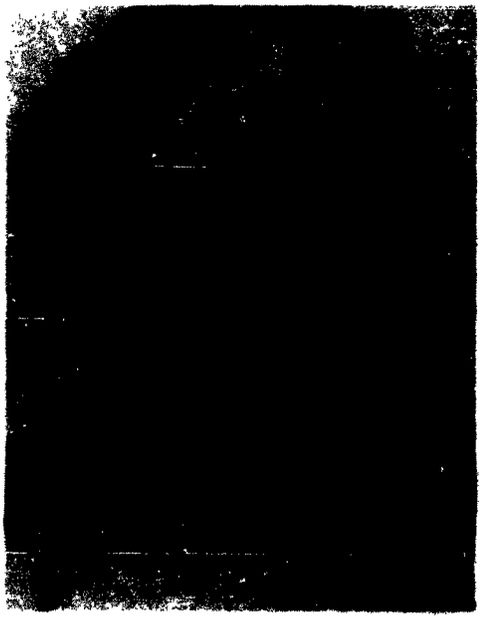


Figure 12.

Baldness, and change in texture of the hair.

[111] Autret and Behar, op. cit., pp. 17-18.

Mucous Membranes: In kwashiorkor abnormalities of the mucous membranes frequently appear. Lips become dry, chapped, and often have deep and bleeding cracks. Lesions are found at the corners of the mouth and are sometimes infected (Figures 8 and 9). The buccal mucosa is red or pale because of anemia. The tongue may be either pale or red, as well as cracked and fissured or smooth.[112]

Hair and Nails: Changes in the hair are frequent and characteristic, affecting both color and texture. The hair is very fine, dry, and brittle (Figures 10, 11, and 12). In severe cases, these changes often become so marked that the scalp is sometimes barely covered with sparse, fine, discolored hair. Changes in color are, in general, not as strongly marked nor as constant as the changes in texture among Indian children.[113]

Quite often the hair which is normally black or dark brown turns blonde, reddish, light brown, and even white. The degree of depigmentation is considered to be related to the severity of the malnutrition, so that a new band, paler than the rest of the hair, is often visible near the roots (Figure 13). This sign is an indication of the pronounced deficiency which the child recently experienced. Periods of relatively good nutrition will appear as dark bands, so that in some cases a child may have several bands suggesting the stripes of a flag. This appearance of the hair was called "flag sign" by Costa Rican investigators where it was seen with great frequency and intensity.[114] Similar bandings have been observed in the eyelashes and

[112] Ibid., p. 18.
[113] Ibid., p. 19.
[114] Trowell, op. cit., pp. 80-83.

eyebrows and finger nails. The nails occasionally show very marked disturbances of growth.[115]

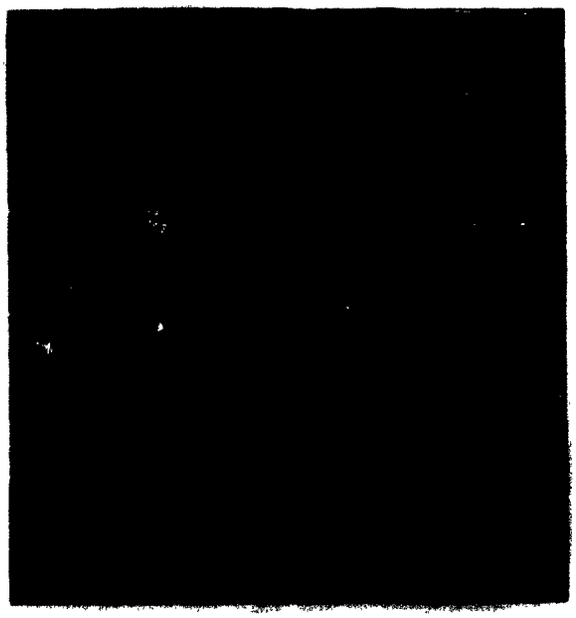


Figure 13.

Banding, or flag sign observed in a boy recovering from kwashiorkor.

Changes in the Muscles: The degree of muscular wasting is frequently severe and is most easily recognized after the initial edema has been lost. Atrophy of the muscles is particularly marked in the buttocks. The lack of muscle tone, combined with the psychological difficulties, is responsible for the poor and feeble motor activity.[116]

[115] Autret and Behar, op. cit., pp. 18-21.

[116] Trowell, op. cit., pp. 73-75.

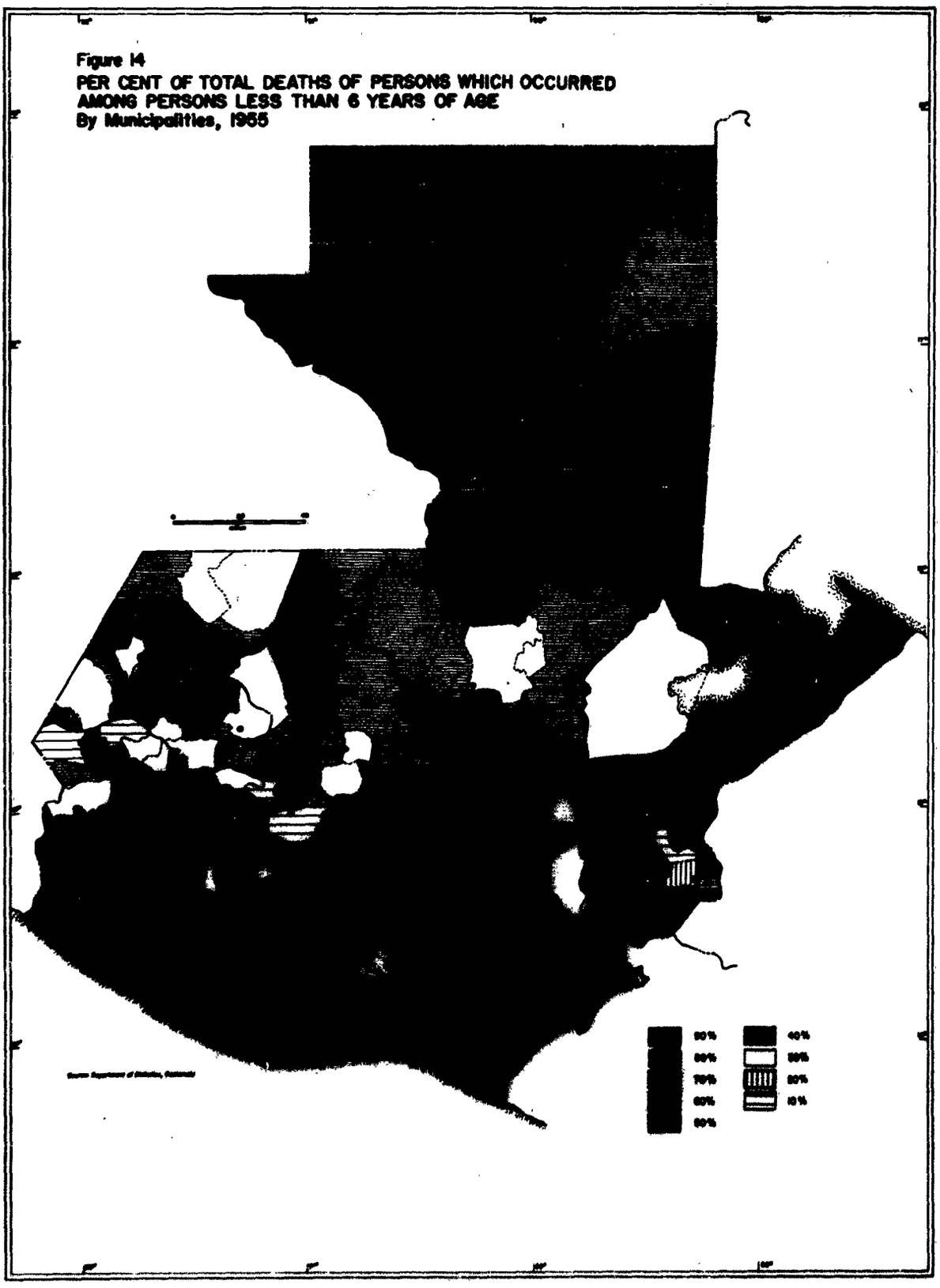
CHAPTER IV

THE METHODS USED IN THE INVESTIGATIONS

Statement of the Problem. The present investigation was a study of the geographical distribution of protein malnutrition and kwashiorkor in Guatemala. Although it was known there was a widespread prevalence of these conditions in Guatemala, there was no exact information available on whether there were appreciable regional differences. Such information would be immediately useful from both the theoretical and practical viewpoints. Regional differences in the extent of malnutrition should provide clues toward a more complete understanding of the etiology of kwashiorkor. If there were regions of very low incidence, then it follows that the country contains within itself some of the resources necessary to reduce the occurrence of malnutrition. A careful study of the factors accounting for the better nutritional state of the people residing in these areas should suggest means for ameliorating the bad state of affairs in other regions. Since medical nutritional statistics were not extant, an indirect measure of malnutrition, mortality, was chosen. A map (Figure 14) was prepared on the basis of the percentage of total deaths in each of the 322 municipalities which occurred in the pre-school group (children one to six years of age).

Study of this map brings out two important points. First, there is a regional variation in the mortality. The proportion of deaths among these children ranges from a high of 90 per cent to a low of 10 per cent. Second, there is a pattern which tends to coincide with the physical geography of Guatemala (compare with Figure 2). In the lowland areas the mortality ranges from 70 to 90 per cent, whereas in the highland areas the mortality is low,

Figure 14
PER CENT OF TOTAL DEATHS OF PERSONS WHICH OCCURRED AMONG PERSONS LESS THAN 6 YEARS OF AGE
By Municipalities, 1955



10 to 30 per cent.

Because the use of an indirect measure of malnutrition was questionable the scope of the study necessarily broadened. A search had to be made not only for an explanation of the regional variations in malnutrition, but also for factors which might clarify why there was a geographical pattern in the mortality among young children. Furthermore, sufficient information had to be collected so that realistic judgments could be made regarding the relative importance of malnutrition in explaining this pattern of mortality.

Selection of the Villages and Towns. To begin the solution of ths problem, ten villages and towns were randomly selected for detailed study, some of which were located in areas of high mortality and some in areas of low mortality. Three considerations limited the towns and villages from which the ten were ultimately selected. First, study of the population figures of the municipalities which had very high or very low mortality rates revealed that they were regions where only a few people lived. This suggested that the mortality was not reliable. A more realistic picture was obtained by considering only those areas in which the mortality ranged between 30 and 70 per cent. Since there was an adequate population density at each of these extremes, villages were selected solely from those municipalities which had a mortality of either 70 or 30 per cent. Villages in the former comprised Group A; the villages in the latter, Group B. The second consideration was that the towns and villages to be studied should have between 100 and 300 pre-school children. Third, localities which were inaccessible, were not considered.

Of the accessible towns and villages in the municipalities with 30 or 70 per cent mortality, five were in Group A and five in Group B. Group A included Concepcion Chiquirichapa, Department of Quezaltenango; San Antonio Palopo, Department of Solola; Puerto San Jose, Department of Escuintla; La Democracia, Department of Escuintla; San Antonio La Paz, Department of El Progreso. Among the villages and towns of Group B were Aquacatan, Department of Huehuetenango; San Pedro Carcha, Department of Alta Verapaz; San Vicente Pacaya, Department of Escuintla; St. Tomas Chichicastenango, Department of Quiche; San Pedro Pinula, Department of Jalapa. During the course of the study it was necessary to eliminate the investigation of San Pedro Pinula (Group B), due to the complete lack of facilities for the research team.

Composition of the Research Team. After the proposed research plan had been approved by the departmental section heads at INCAP, participants were appointed. The team consisted of nine persons, seven of whom were engaged in the investigations carried out in the field and two who served as consultants and remained at INCAP.

The author was appointed co-director of the group. His principal duties included the collection of detailed data on the environmental elements and photography. The responsibility for the direction of the study was shared with the head of the Field Unit, Health Department, a medical officer who worked with INCAP. He directed the medical phase of the project and was assisted by several doctors who had been sent by the Hospital Enfernedades

Nutricionales, Mexico City, to INCAP to receive field training in clinical nutrition. A social worker from the Field Unit, Health Department was assigned to the team; her duties were to serve as a translator for those Indians that spoke only dialects and to assist the physicians. The author's wife served as secretary for the project and was responsible for the collection of all statistical information. Transportation and drivers were provided by both INCAP and the Public Health Department of Guatemala.

In the absence of the director, the associate director of INCAP served as the chief medical consultant for the team. The statistician at INCAP directed the statistical portion of the research. He made the selection of the villages and towns and assisted in the compilation of data from the physical examination sheets.

Indoctrination of the Team: Before the team went into the field, there was a period of indoctrination. In order to become acquainted with the people, their habits and customs, and the rural scene, all members of the team who had not previously participated in field projects in Guatemala spent several days in a village near Guatemala City. Under the guidance of the associate director of INCAP and the head of the Field Unit, Public Health Department, team members were instructed in proper field methods and in the use of various forms for the physical examination and inventory of geographical factors.

In addition to these daily visits, all participants were instructed in the recognition of the 65 clinical signs incorporated in the examination sheet. Under the guidance of the associate director and other section heads at

INCAP, frequent sessions were held in which these signs, nutritional deficiencies, and kwashiorkor were discussed. Photographs and motion pictures were utilized to elaborate certain critical points and clarify differences, especially for the non-medical members of the team.

Team physicians were given an opportunity to observe clinical signs and evaluate them. Ward rounds were made by these doctors during which time each of them examined a number of cases of clinical malnutrition. Under the guidance of the associate director, an effort was made to train the physicians so that each would recognize the important signs of malnutrition and rate a given sign with the same intensity. Differences in judgment can be rather large in this type of physical examination. Since it would be impossible in the field investigation for every child to be examined by every doctor, it was necessary to attempt to reduce as much as possible these individual differences in clinical judgments. To improve further the objectivity of the clinical examination, the medical officers were never informed about the classification of the nine villages and towns which had been selected for study.

After seven to ten days of this type of practical training, the entire team, including advisors, spent several days together in a final discussion of goals, methods, and anticipated problems.

Types of Data Collected. In order to make as holistic an investigation as possible of these nine villages, it was decided to adopt an ecological approach. Detailed information was collected both of the environmental elements and also of the organism and its function. The inventory of

information amassed has been summarized in Table 9.

Methods of collecting the data: Upon arrival at a town or village, the team sought out the mayor and explained the purpose of the visit. After receiving his permission and promise to cooperate, space was acquired in which the physical examinations were to be made. Usually a school, one of the municipal offices, or the dispensary were used.

The mayor was then asked to inform the populace that physical examinations of all children under six years were to be made, at no charge, and that no blood was to be taken. He used several methods to spread this information. Sub-officials went from house to house, or a man, beating a drum, walked along the streets shouting the details, or written notices were posted throughout the settlement.

Facts concerning the environmental elements were obtained from the mayor's office, whenever possible. A guide directed the author to the various farms and aided in entering dwellings. This task was undertaken normally by the chief-of-police or one of his staff. These people proved to be especially valuable in acquiring information concerning agricultural yields, animals, and income. All information was recorded on an appropriate questionnaire, an example of which is included in the Appendix (Appendix A).

Clinical Examination. To facilitate the nutritional appraisal of large numbers of subjects, a form (Table 10) was used which had been developed by INCAP. This form was based on a long experience in the field of clinical experience

TABLE 9

INVENTORY OF DATA COLLECTED BY RESEARCH TEAM

Geographical Factors	Agriculture	Population Statistics	Economic Basis	Sanitation
Topography	Farm sizes	Indian	Subsistence or	Water availability
Climate	Types and yields	Ladino	commercial-	Toilet facilities
Soils	Methods	Sex	Farming	Garbage disposal
Vegetation	Mechanization	Age	Manufacturing	Rodents, insects
	Animals		Services	Washing facilities
				Cooking facilities

House Types	Community Services	Living Standard of Family	Physical Examination	Utilities
Number of rooms	Type of stores	Type of furni-	Height, weight	Electricity
Roof construction	Medical, dental	ture	Signs and	Water
Type of wall	Administrative	Diet	symptoms of	Telephone
and floor	Religious	Clothes	nutritional	Telegraph
Windows, doors	Educational	Number of	deficiency	
Ventilation	Transportation	people employed		
	Postal	Income	Skin-fold thickness	
	Market			

in Central America and included an inventory of signs and symptoms which those investigators had found to be most indicative of malnutrition. In addition, the form provided spaces for thoroughly identifying the individual subjects and for recording measurements of skinfold thickness, weight, and height. The material included in the examination has been summarized in Table 10.[117] For the sake of brevity, the spaces provided in the original form for grading the severity of the clinical signs have been omitted.

The social worker and Mrs. Slutsky served as secretaries for the examining doctors and recorded their evaluations of the clinical signs. A separate sheet was used for each child. Photographs were taken of the different signs and of children in various stages of nutritional deficiencies.

Weight and Height: All weights (in pounds to the nearest source) were measured on a portable Fairbanks-Morse scale. A cloth measuring tape was attached to a wall and all heights were recorded to the nearest centimeter. These heights and weights were taken by the physicians and secretaries.

Skinfold thickness: Through the use of a special spring caliper, skinfold thickness was determined on only one arm. Three readings were taken of the thickness of the folds of skin and subcutaneous tissue on the posterior surface of the right arm, midway between the elbow and the point of the shoulder.

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[117] J. Antonio Munoz and Carlos Perez, "Elexamen cliniconutricional," Revista del Colegio Medico de Guatemala, Vol. V, No. 2, June, 1954, pp. 117-127

TABLE 10

INCAP'S PROTOCOL FOR NUTRITIONAL SURVEYS Place_____ Date_____

Birthday_____

Name_____ Age_____ Sex_____ Race_____ Skin fold_____ Weight_____

(Ladino or Indian)

Place of birth_____ Examiner_____ Height_____

HAIR

1 Pre flag appearance
2 Flag sign

EYE LIDS

3 Blepharitis
4 Crusty lids
5 External angle lesions

PALPEBRAL CONJUNCTIVA

6 Inflammation
7 Folliculosis

BULBAR CONJUNCTIVA

8 Dryness
9 Thickening
10 Generalized vascularity
11 Blue-black pigmented spots
12 Vascularity - type A
13 Pigmentation - type A
14 Pterigion

CORNEA

15 Opacities of corneal limbus
16 Vascularity of limbal circle
17 Brown limbus

FACE

18 Sub-orbital pigmentation
19 Nasoliabial seborrheal reddening
20 Bilateral erythema
21 Discromic spots - grade I
22 Discromic spots - grade II
23 Discromic spots - grade III

LIPS

24 Acute cheilitis
25 Chronic cheilitis
26 Angular stomatitis

GUMS

27 Marginal gingivitis
28 Generalized gingivitis
29 Hypertrophy
30 Atrophy

TONGUE

31 Magenta
32 Red
33 Edematous
34 Ulcerated
35 Hypertrophy of fungiform papillae
36 Hypertrophy of filiform papillae
37 Fissuration
38 Atrophy
39 Geographic tongue

TEETH

40 Caries
41 Serrated edges
42 Worn down edges
43 Loss of teeth
44 Faulty implantation
45 Spotted enamel

Table 10 (Continued)

MUCOUS MEMBRANES

46 Paleness

NECK

47 Hypertrophy of parotid glands
48 Goiter

SKIN

49 Dry and cracked
50 Xerosis
51 Follicular hyperkeratosis
52 Acrocyanosis
53 Pellagroid erythema
54 Pellagroid intertrigo
55 Pellagroid hypertrophy
56 Atrophy
57 Follicular petechiae

ABDOMEN

58 Prominent

NAILS

59 Striations
60 Fragility

SKELETON

61 Cranio-tabes
62 Diaphyseal-epiphyseal widening

NERVOUS SYSTEM

63 Altered reflexes
64 Loss of vibratory sensation

SUBCUTANEOUS TISSUE

65 Edema

GENERAL

66 Other signs (note any disease or deformity especially alopecia, eczema, petechia, fungus infections, genu varum, genu valgum, scoliosis, lordosis, splenomegaly, hepatomegaly, etc.)

67 Nutritional Status

Excellent_____ Regular_____
Good_____ Poor_____

COURTESY OF INCAP

Clinical Signs: The examining physicians looked for 65 signs. Each sign was graded, according to severity, as doubtful, slight, moderate, or severe. Before describing these signs it is necessary to comment on their specificity. The major premise of a nutritional inspection of a child is that there are clinical signs which indicate to the doctor that the individual is malnourished. This premise contains two major limitations. First, a number of the signs are actually non-specific.[118] While they may be due to malnutrition, they may also be caused by exposure to wind, dust, and sunlight, minor trauma such as wearing tight belts and clothing, and sensitivity to certain cosmetics. Second, a number of these signs, while they are frequently seen among malnourished individuals, have not yet been proven to be due to a nutritional deficiency. Therefore, one must be very cautious in concluding that an individual exhibiting these signs is in fact malnourished. Certainly the more signs one has and the more severe those signs are, the more likely it is that there is malnutrition.

1. Pre-flag sign (hair): Hair dry, brittle, discolored reddish-yellow; lacks normal luster and softness; may be pulled out with ease; protein deficiency.

2. Flag sign: Band of light colored hair between areas of normal, dark colored hair. sign correlated with length and severity of disease.

3. Blepharitis (eyelids): Inflammation of eye; vitamin A deficiency.

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[118] James S. McLester and William J. Darby, Nutrition and Diet (Philadelphia: W. B. Saunders Company, 1952), pp. 61-96, 107-125.

4. Crusty lids: Small, crusty white lesions bordering eyelids; persistent hyperemia; crusts easily removed; vitamin A deficiency.

5. External angle lesions: Moist, reddish, seborrheic lesions; deficiency of vitamin B complex, especially vitamin B_2.

6. Inflammation (palpebral conjunctiva): Ocular lesions, followed by secondary infection; first stage in development of palpebral folliculosis; vitamin A deficiency.

7. Folliculosis: Enlargement of lymph follicules under palpebral conjunctiva; small, yellow transparent spots; vitamin A deficiency.

8. Dryness (bulbar conjunctiva): Conjunctiva lacks brightness, transparency, and elasticity; vitamin A deficiency.

9. Thickening: Thickening, loss of transparency, and cellular proliferation of subconjunctival vascular net; vitamin A deficiency.

10. Generalized vascularity: Congestion and proliferation of vascular net; analogous to blood-shot eye; cause unknown.

11. Blue-black pigmented spots: Small, irregular spots of varying size and form usually found at ends of blood vessels in area covered by eyelids; cause unknown.

12. Vascularity - type A: This sign, although similar to No. 10, occurs in area normally not covered by eyelids; etiology unknown.

13. Pigmentation - type A: The color of normally exposed conjunctiva changes to yellowish brown; cause unknown.

14. Pterigion: Extreme thickening and growth of bulbar conjunctiva through center of cornea; cause unknown.

15. Opacities of corneal limbus (cornea): Black, irregular, opaque spots at edge of cornea; vitamin A deficiency.

16. Vascularity of limbal circle: Conjunctival blood vessels to edge of cornea; vitamin B deficiency.

17. Brown limbus: Brown arch, varying in size and shape; situated around lower pole of iris; etiology unknown.

18. Sub-orbital pigmentation (face): Triangular, brown spots between lower eyelid and cheekbone; vitamin B_3 deficiency.

19. Nasolabial seborrheal reddening: Moist, reddish seborrheic lesions at nasolabial angle; vitamin B_2 deficiency.

20. Bilaterial erythema: Brownish or reddish pigmentation of both cheeks; vitamin B_3 deficiency.

21, 22, 23. Discromatic spots: Spots may occur on any part of body, but most frequently on face; Grade I, dry, whitish, irregularly shaped spots; Grade II, scaly lesion; Grade III, combination of Grades I and II plus exudation; cause unknown.

24. Acute cheilitis (lips): Labial mucosa of lips acutely inflamed; vitamin B complex and iron deficiency.

25. Chronic cheilitis: Chronic strophic inflammation of labial mucosa; vitamin B complex and iron shortage.

26. Angular stomatitis: Lesions and fissures at angles of mouth; vitamin B complex deficiency, especially vitamin B_2.

27. Marginal gingivitis (gums): Gums red, swollen, soft and bleed easily when touched; vitamin C deficiency.

28. Generalized gingivitis: Advanced stage of No. 27; gums separated from teeth; vitamin C deficiency.

29. Hypertrophy: Thickening and hardening of gums; vitamin C deficiency.

30. Atrophy: Regression of gums; cause unknown.

31. Magenta (tongue): Purplish, discoloration; vitamin B complex deficiency.

32. Red: Papillae of tongue inflamed red; vitamin B_3 deficiency.

33. Edematous: Inflammation and edema of tongue; vitamin B_3 deficiency.

34. Ulcerated: Circular ulcerations on inflamed tongue; cause unknown.

35. Hypertrophy of fungiform papillae: Papillae enlarged at tip of the tongue, along border, and base; vitamin B complex, iron, and folic acid deficiencies.

36. Hypertrophy of filiform papillae: Enlarged papillae cause tongue to appear thicker than usual; vitamin B complex, iron, and folic acid deficiencies.

37. Fissuration: Cuts or fissures on upper lingual surface; associated with deficiencies listed in No. 36.

38. Atrophy: Tongue smooth and thin; chronic vitamin B complex iron, and folic acid deficiencies.

39. Geographic tongue: The simultaneous occurrence of all previously mentioned lingual signs; vitamin B_{12} deficiency.

40. Dental caries: Decayed areas or cavities; multiple nutritional deficiencies.

41. Serrated edges: Teeth have irregularly shaped edges; cause unknown.

42. Worn down edges: Smooth surfaces replace normal sharp borders and peaks of molars; calcium and nutritional deficiencies.

43. Loss of teeth: Loss of teeth indicates possibility caries or gingivitis occurred at earlier date.

44. Faulty implantation: Irregular alignment of teeth; cause unknown.

45. Spotted enamel: Non-removable brown or black spots; various multiple deficiencies or excessive intake of fluorine.

46. Paleness (mucous membranes): Loss of color by mucous membranes; nutritional deficiencies.

47. Hypertrophy of parotid glands: Swelling of the parotid and submaxillary salivary glands; protein deficiency.

48. Goiter: Classified according to three grades; Grade I, thyroid gland four to five times normal size; Grade II, gland easily detected when head in a horizontal position; Grade III, gland visible at a distance; iodine deficiency.

49. Dry and cracked skin: Skin on arms and legs dry, smooth, and cracked; vitamin A or essential fatty acids deficiencies.

50. Xerosis: Dryness continues, skin thickened; sebaceous sweat secretion restricted; associated with lack of nutrients listed in No. 49.

51. Follicular hyperkeratosis: Enlarged hair follicules on outer surfaces of arms and legs; associated with same deficiencies as No. 49.

52. Acrocyanosis: Skin of hands and feet bluish-purple; atrophy; cause unknown.

53. Pelagroid erythema: Reddening of skin in areas exposed to light; no relation to amount of sunlight received; vitamin B_3 deficiency.

54. Pelagroid intertrigo: Cutaneous folds under breasts, in groin, and in axillae inflamed and moist; vitamin B_3 deficiency.

55. Pelagroid hypertrophy: Skin dry, thickened, and inelastic; associated with lack of nutrients listed in No. 54.

56. Atrophy: Skin dry, scaly, and tight; in exposed areas easily traumatized by pressure, friction, and sunlight; protein deficiencies.

57. Follicular petechiae: Capillaries rupture around hair follicules; subcutaneous bleeding slight; vitamin C deficiency.

58. Prominent abdomen: Enlarged abdomen; protein deficiency or excessive carbohydrate intake.

59. Striations (nails): Transverse ruts or striations mark the smooth nail surface; protein and calcium deficiencies.

60. Fragility: Nail fragile and brittle; definite loss of flexibility; associated with lack of nutrients listed in No. 59.

61. Cranio-tabes (skeleton): Cranial bones atrophied; vitamin D deficiency.

62. Diaphyseal-epiphyseal widening: Ends of long bones widened; vitamin D deficiency.

63. Altered reflexes (nervous system): Increased or decreased tendon reflexes; vitamin B_1 deficiency.

64. Loss of vibratory sensation: Not tested, reliable response could not be elicited from these young patients.

65. Edema (subcutaneous tissue): Skin swollen and puffy, due to retention of subcutaneous fluids; protein deficiency.

66. Other signs (general): Alopecia, eczema, petechia, fungus infections, genu varum, genu valgum, scoliosis, lordosis, splenomegaly, hepatomegaly.

67. Nutritional status: Nutritional status of the subject was assessed by the medical examiner; it was subjectively graded according to excellent, good, regular, or bad. In addition any disease which could be diagnosed on the basis of a clinical exmination and which was noted by the doctor was recorded. These conditions were specifically noted parimarily because they have been seen frequently among malnourished children in Guatemala. Whether or not they are caused by malnutrition is doubtful.

CHAPTER V

VILLAGES EXAMINED

Group A. Five villages were investigated in this group; the statistics obtained for these villages have been summarized in Table 11. A brief description of the environmental elements characteristic of each follows.

Concepcion Chiquirichapa: Situated in a small valley near the upper limits of the Central Highlands, Concepcion (Figure 1) is virtually surrounded by mountains reaching above 11,000 feet (Figure 15). Most of the area consists of rocky, untillable mountainsides heavily forested with pine and oak. The majority of the arable land is eroded and improverished; only a small percentage is rated good - - that restricted to the intermountain valley plain.

The climate is cool; temperatures vary from 41° to 59° F. In December and January, early morning temperatures drop below 32° F. The dry season (Verano) is from December to June, usually a period of five to six months. At this high altitude dense mists and dews occur frequently.

The vegetation was comprised of extensive stands of oak and pine. Above 10,000 feet, oak gave way to spruce and the forests were generally half-hidden by the mists. The coolness of the climate placed an added degree of importance upon the forests. The majority of the valley had been repeatedly cleared for agriculture, so that it was covered only with grass.

The forested mountainsides provided an abundant source of firewood for the settlement. Deforestation had resulted; steep, eroded ravines (barrancas) and gullying were extensive (Figure 16).

Figure 15.

A portion of the intermountain valley and a typical farm. Note the deforestation and gullying which has occurred on adjacent mountains.

The majority of the employed villagers engaged in subsistence agriculture. The land farmed was the property of the village, but the villagers did not pay rent for its use. In practice, a tract that had been assigned by the authorities at sometime in the past to one family for its use had generally reamined in that family. It was also a common procedure among families to buy and sell the rights to use certain tracts.

Therefore, the land was operated by the farmer as if it was his private property.

The majority of the arable land is in corn and is tilled continuously. Due to the high altitude the length of the vegetative period is a little less than continuous. Planting takes place in February and harvesting occurs in January. The average yield of corn is 15 bushels per acre. Corn yields

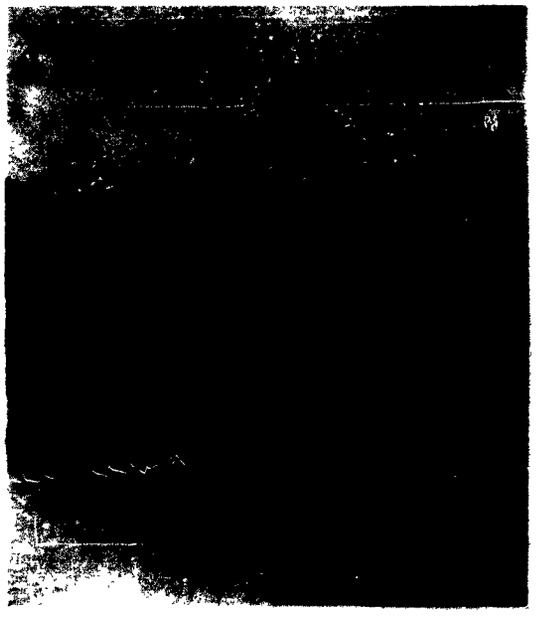


Figure 16.

Deforestation has resulted in extensive and serious erosion and gullying.

increase to 20 bushels per acre on farms where animal manure is employed. Farmers who are not able to engage in animal husbandry have only leaves of corn and other plants for fertilizer and obtain the lowest corn yields, 10 bushels per acre.

Wheat and oats are planted as commercial crops. Planting takes place in October and November, and the harvest is in June and July. The land is prepared for planting much as it is for corn, but not plowed so deeply; furrows are only six to eight inches deep and 20 inches apart. The grain is hand-sowed and covered by a shallow layer of dirt. Wheat and oats are not manured and yields are low. Those farmers who raise wheat and oats sell most of the grain to flour millers in Quezeltenango in order to purchase corn.

The single legume planted was the broadbean (haba). It was usually planted between rows of corn but, in a few cases was grown alone in small fields. The broadbean was grown as a commercial crop and sold in nearby markets and in Quezeltenango.

Concepcion is in one of the premium potato-producing areas of the country. Both the American and native varieties are grown and over 20 per cent of all cultivated crops are potatoes. The larger American variety is planted annually in February and March and harvested in June; the smaller native variety is planted in December and January and harvested in July and August. Yields average about three tons per acre.

Vegetables and fruits were scarce, and none was raised commercially. In the village, vegetables (cabbage, onions, squash) were grown in small gardens. Each dwelling had its own vegetable garden and all produce was consumed by the respective owner. The only fruits that were grown on a large scale in the region were peaches and apples; Concepcion was particularly noted for the abundance of peaches. However, the fruit was of very poor quality: small, green, hard, and generally inedible unless cooked.

Animal husbandry played a small, but important, part in the basic economy. Milch cows, though not numerous, predominated over beef animals. The close green alpine meadows provided adequate pasturage for the numerous flocks of sheep owned by the villagers. Wool clippings averaged about five pounds per head per year. Most of this raw wool was sold in the major wool-weaving villages and towns east of Quezeltenango, particularly in Momostenango. Pigs were kept for cash, but the shortage of corn, fruits, nuts, and other sources of feed restricted the number raised. Poultry (chickens, turkeys, ducks) were not uncommon. They were used primarily for home consumption, with a small surplus reserved for the market. Almost all eggs were sold and the income used to purchase corn and beans. Beasts of burden were utilized as pack animals to transport corn, wheat, beans, and firewood to the various markets.

Although the Indian farmers grow cash crops (wheat, potatoes, broad-beans) in addition to corn, the majority find it impossible to grow enough to feed themselves or to obtain sufficient money from the sale of cash crops to purchase basic foodstuffs. The average farm of 2.8 acres is not large enough either to support the farm family or to offer full-time employment for the male members of the family. Each year, agents from the large plantations, ranches, and government holdings to the south recruit Indian labor in Concepcion. The Indian is either transported or migrates south to perform seasonal activities, such as coffee picking, cutting sugar cane, and clearing fields. The supply of this source of cheap labor from the Central Highlands is economically important. Without these

seasonal Indian laborers, the present commercial agricultural economy of Guatemala would collapse.

Concepcion is only four miles from the important trade route between Quezeltenango and San Marcos. Although the village has only 1.3 miles of paved roads, all connecting roads, though unpaved, are passable the year around. The village has a rectangular settlement pattern and focus is on the central square. Around the square are the school, church, mayor's office, and several stores; in the center is the main well (pila).

The Ladino residents live adjacent to the central square and are dominant in the commercial economy and politics of Concepcion. Their homes, reflecting their improved standard of living, are white washed, have more furniture, better lighting and ventilation, and are cleaner than those of the Indians. The latter, on the other hand, are engaged basically in agricultural activities. Indian housing is overcrowded, uncomfortable, and unsanitary. The majority of the dwellings have no separate kitchen and small animals and poultry have ready access to sleeping and eating quarters. Many of the Indians' houses lack toilet facilities and the people are forced to use either a neighbor's or an adjacent field.

Medical facilities were lacking; no medicines were sold in the six local stores. There was no market day and only a few items, such as coffee, salt, bread, sugar, beer, and whiskey, were available in the general stores. Individual Indian vendors appeared in the village at least once a week and generally handled, in small quantities, such items as coffee, dried chile, candles, incense, rice, cacao, cotton, hats, herbs, beads and trinkets, cigars, and salt.

Erosion, small submarginal farms, lack of manures, and continuous cultivation have resulted in small, inadequate yields of both subsistence and cash crops. The coolness of the climate has also limited the variety of vegetables and fruits available for human consumption. These facts plus the low average yearly income of the Indian, $129, account, in part, for the scarcity of food and meagerness of the diet.

San Antonio Palopo: Bordering Lake Atitlan are several Indian villages, separated from each other by distances ranging from less than one mile to as much as 10 miles. Their inhabitants, descendants of the Indian nations that once ruled this region, are primarily agriculturists.

One of the most isolated villages investigated, San Antonio Palopo (Figure 1), is located on the northeastern shore of Lake Atitlan. The village is accessible only by water or a narrow footpath. This path leads south to the other lake villages and north to Panajachel, a resort through which runs the important highway between Guatemala City and Chichicastemango, the country's chief tourist attraction.

Situated several hundred feet above the lake on rocky slopes, the settlement had many unique features. Whereas other villages used the lake for a variety of practical purposes, San Antonio Palopo rather looked to the land for support. While many villages used the lake as their permanent water supply, several mountain streams cascaded over adjacent cliffs and flowed past San Antonio Palopo. Other lake villages were readily accessible by water transportation, but high shore promontories isolated this village from tourists as well as neighboring lake villagers (Figure 17).

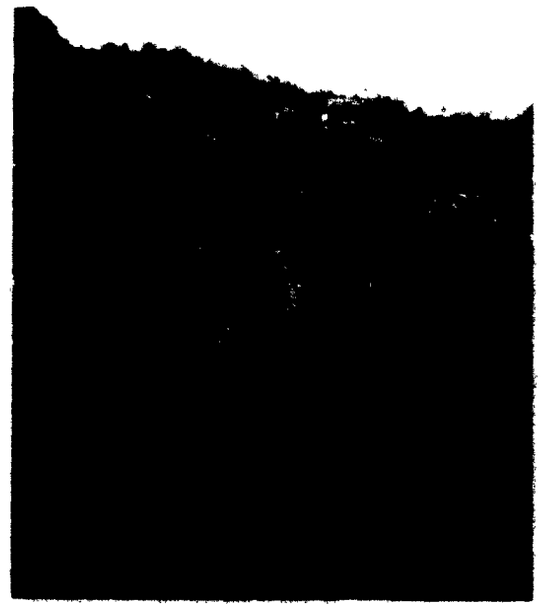


Figure 17

Steepness of slope, high promonotories, and corn cultivation in area adjacent to San Antonio Palopo.

Steep cliffs stand over 1,000 feet above the village and level land is almost nonexistent. The steepness of the slope ranges from 15 to 50 degrees (Figure 18), but regardless of its severity all arable land is cultivated.

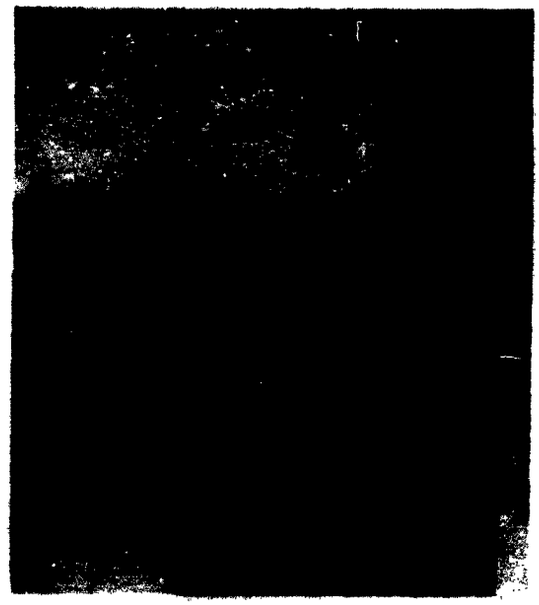


Figure 18

Traditional costume of the San Antonio Palopo villagers. In background, steepness of slope of arable land bordering Lake Atitlan.

The villagers practiced both subsistence and commercial agriculture. The principal subsistence crop was corn and comprised almost 90 per cent of all cultivated crops. Even though almost all arable land was planted in corn, yields failed to meet local needs. Erosion, lack of animal manures, and impoverished soil were the chief reasons for low corn yields.

Wheat was planted on the higher slopes, but the crop amounted to less than two per cent of the total harvest. The low altitude, steepness of slope, and lack of fertilization resulted in poor yields and the total wheat acreage has decreased each year.

In addition to the basic subsistence crops, a variety of vegetables were raised commercially. At low levels, near the village, premium or near-level land was carefully and intensively gardened. Man-made terraces which reduced erosion were kept in constant repair. The garden plots (tablones) were fertilized mainly with leaf litter and animal manure, when obtainable. Adjacent streams furnished ample water for the network of diversion ditches that were used to irrigate the fertilized terraces (Figure 19).

The vegetables raised were onions, cabbages, tomatoes, chiles, and aniseed, the latter being used mainly for flavoring drinks and in baking. Although the total area devoted to vegetables and aniseed was approximately 100 acres, intensive agricultural methods resulted in large yields of quality produce. The majority of the vegetables were sold in the nearby large markets while the aniseed was transported via truck to Guatemala City.

Uncultivated fruits were abundant along the numerous wooded stream courses. Only a small portion of the peaches, quavas, and "Spanish plums" (jocote) were consumed locally. The majority were sold in the larger urban

settlements. Avocados and coffee were also grown in quantity; the coffee was sold, but the avocados remained in the village and were consumed by the Indians as a source of dietary fat.

The lack of pasturage and feed restricted animal husbandry almost exclusively to pigs and poultry. A few horses and mules were used primarily to transport vegetables and fruits to market. The number of pigs kept was

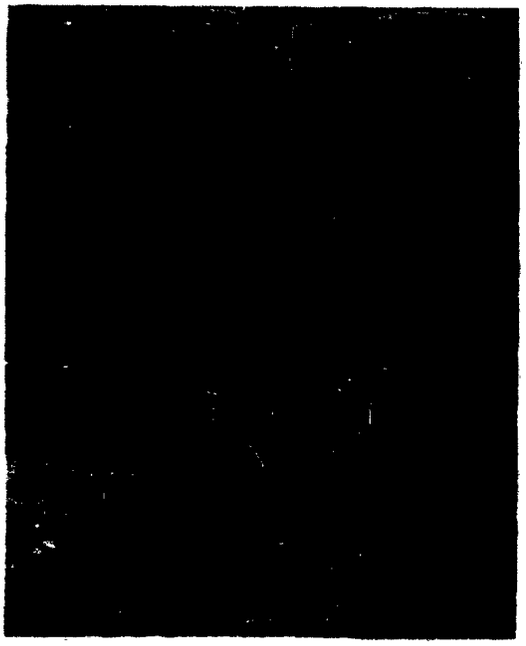


Figure 19.

Man-made terraces for the commercial vegetable garden economy of San Antonio Palopo.

small and these animals were all destined for outside markets. Only poultry was slaughtered in the village. Beef and pork were brought in twice a week from Panajachel. The number of eggs gathered each day varied from four to six dozen and no milk was available.

While the villagers looked only to the land for their subsistence, some did engage in a small amount of fishing in the lake. Only a few varieties of fish, all small, were found and these were caught mainly by hook and line. Fish seines, traps, and cane funnels were also used, but with little success. Small crabs were caught whenever possible and were used to make a fish soup. Fishing was done only by women and children under seven years of age.

Industrial pursuits were completely lacking at San Antonio Palopo. Only a few villagers were willing to work as laborers on large farms in the region. None would serve as itinerant laborers in the lowlands. Commercial activity was secondary; a few men bought vegetables and sold them in villages in the Piedmont and Coastal Plain. Ladino vendors passed through the village on their way to larger settlements, but remained only a short time. On Wednesdays Indian merchants from the larger lake villages established a small market in the central square and sold dried fish, corn, soap, salt, coffee, beans, fruit, and candles. Even though the village was situated on steep, rocky slopes several hundreds of feet above the lake (Figure 20), it occupied an intermediate position on the circuitous land route that connected all of the Indian lake villages.

In the center of the compact village was the town square, in which were located the church, school, municipal offices, and well. Three wells (pilas) supplied drinking water, washing was done either in the lake or in the back of the house. Until recently no medical facilities or medicines were available. Midwives performed maternity services for expectant mothers. In October, 1957, the Department of Public Health constructed and equipped

a dispensary. Since it had not been staffed for several months, its success was dubious.

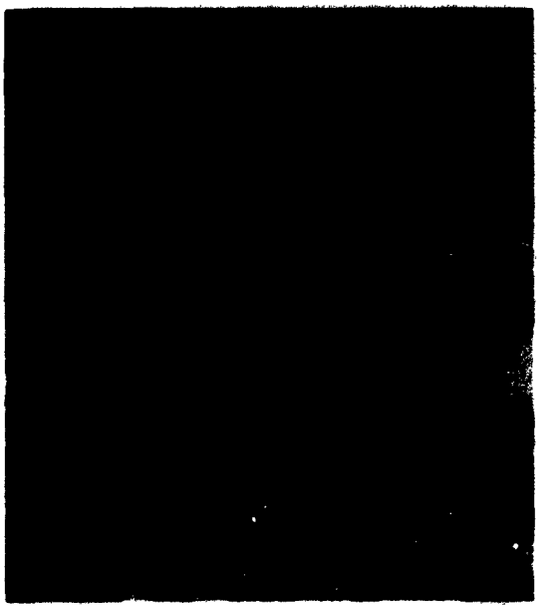


Figure 20

Village of San Antonio Palopo and adjacent steep slopes.

Each dwelling had a small garden, in which were a few coffee and fruit trees. So inclined were the villagers to gardening that the majority of the gardens were planted in onions, cabbages, and tomatoes.

Attached to many of the houses was a small structure made of stone with an adobe roof. These sweat houses were used for steam and warm-water baths. The villagers disliked cold water, which they regarded as unhealthful for drinking and bathing.

Sanitation was almost completely lacking. Over half of the houses had no toilet facilities and human excrement was observed in yards and paths throughout the village. There was inadequate storage for corn and vegetables and evidence of rodents was seen in the majority of the dwellings. Refuse was thrown into the yards and paths.

The diet of the pre-school child was that of tortillas and black coffee. Beans, vegetables, fruits were not consumed in large quantities but did occasionally enter the diet. The increased cost of the few items sold by vendors to the villagers reflected the isolation of San Antonio Palopo and the difficulty of transporting products to it.

San Antonio La Paz: Less than 10 miles from the important Atlantic Coast Highway connecting the capital with Puerto Barrios, this village is not readily accessible. Situated in a small valley in the South-eastern Uplands, San Antonio La Paz (Figure 1) is bordered by numerous steep and deeply eroded hills. Essentially the topography is a hill and valley arrangement, but it has been greatly altered by extensive erosion and gullying. The soils are generally shallow and unproductive; the choicest soils lie in the depressions and on the gentle, lower slope of the hills.

The climate, in comparison with that of the Central Highlands, is enervating. The region comprises a portion of a rainshadow valley, surrounded by fault-block mountains. The protected valleys have a definite rainfall deficiency and the entire region is the driest part of the country.

Rainfall is regarded as unreliable by the villagers; frequent droughts have been experienced.

The vegetation of the area reflected the combined action of all the physical elements of the environment, especially rainfall. A great majority of the land was unfit for permanent cultivation and has been left in its natural state. Depending on the precipitation, the natural vegetation varied from sub-savanna to zerophytic and was sparse and scattered. Good woodlands were few except at the higher altitudes and deforestation was progressing at a rapid rate.

There is not only a low precipitation, but a general lack of streams flowing through the area that might supply water for irrigation. Whereas the waters of the Rio Motagua are used to irrigate other nearby areas, San Antonio La Pax must rely solely upon precipitation to maintain its crops.

Approximately 65 per cent of all arable land was planted in corn. The average yield was 13 bushels per acre and varied according to the farm size, degree of slope, and amount of fertilization (Figure 21). The smaller farms produced 10 bushels per acre while larger ones yielded 16. Regardless of size, the farms were not able to produce enough to meet even local needs. In comparison with other corn-producing regions throughout the country, San Antonio La Pax ranked very low. In the Coastal Lowlands, yields were well over 30 bushels per acre.

Beans and yucca were produced on a small-scale by almost all of the farmers. These crops, along with corn, served as subsistence products, but all failed to meet the basic needs of the villagers.

Figure 21

A characteristic small corn field in the area of San Antonio La Paz. Note steepness of slope and poorly cleared area.

From 75 to 125 acres of sugar cane were planted. When precipitation was above normal, the crop did extremely well. Since there was no mill in or about the village, the sugar was produced as panela and sold in Guatemala City.

Besides panela, the villagers obtained money from the sale of fruits and coffee. No vegetables were raised commercially. Coffee yields were low, but what was produced in the shade of orange, mango, avocado, and peach trees was sold in the capital.

Due to the low rainfall there was a definite lack of pasturage and only a few low-grade cattle and milch cows were kept. Pigs were raised for sale in the nearby larger markets. Beasts of burden were the most numerous animals and were used to transport agricultural produce, firewood, and charcoal from the fields and higher elevations to San Antonio La Paz. Poultry were plentiful and were also sold for cash.

Commercial activity was secondary to agriculture, but many men were engaged in obtaining forest products. Farmers supplemented their meager agricultural incomes by cutting large quantities of firewood. Charcoal was produced at the higher elevations and a small amount of board lumber was cut. These wood products were sold entirely in Guatemala City. However, neither farming nor forestry enabled the villagers to meet their basic food requirements and the majority hired themselves out as itinerant laborers.

The village is not the usual rectangular settlement pattern introduced by the Spaniards. Municipal offices, church, and school bordered the small square which was located near the entrance to San Antonio La Paz. Houses were widely dispersed (Figure 22). There were only a few stores and all were parts of residential dwellings.

Although medical facilities were lacking, various medicines were sold in several stores. Sanitation was bad and there were no wells or running streams in or near the village. Drinking water was obtained from 37 small, open catchment basins, the majority of which were foul and

dirty. Bathing and washing of clothes were done either at home with water stored in earthen containers or at a small intermittent stream, located some distance from the village.

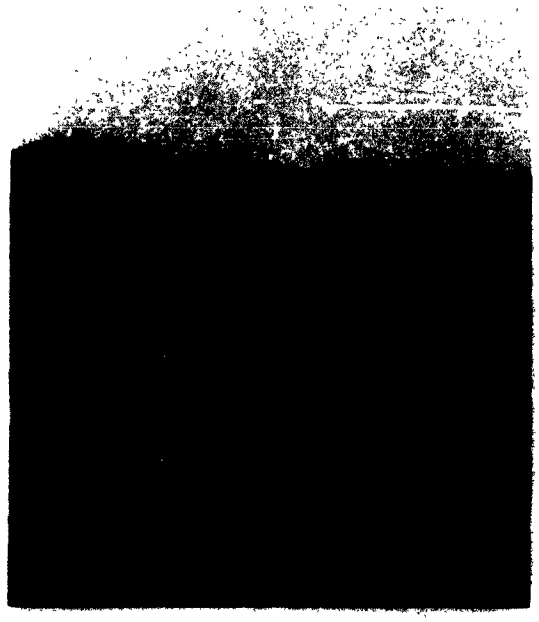


Figure 22.

Village of Sān Antonio La Paz, showing widely dispersed houses.

A milk program, supervised by the school teachers, had been in effect for two months and, for the children of school age, provided the only source of their daily milk requirement.

Puerto San Jose: The largest town examined in Group A, San Jose (Figure 1) is Guatemala's most important Pacific port. At an elevation of less than 20 feet above sea level, the town is situated between the meandering Guacalate and Obrero Rivers that flow across the Pacific Coastal Plain. The adjacent shoreline is marked by steep, but regular beaches. A long embayment parallels the coast and extends from San Jose to Iztapa, a neighboring village. Extensive areas of mangrove swamp are found within a few hundred feet of San Jose. On higher and drier land, small groves of corozo palms are distributed irregularly.

The alluvial coastal lowland has an open vegetation. Along the rivers, lagoons, and embayments, however, are thick gallery forests whose tall trees and dense undergrowth obscures the banks. Between the rivers, the relatively open park savanna landscape dominates.

With annual temperatures over 77° F and a constant high relative humidity, the region has a hot, oppressive climate. Heavy tropical rains occurring in the wet season (May to October), especially along the upper slopes of the Pacific Piedmont, have resulted in frequent, widespread flooding of areas about the port. Almost all of the total precipitation (approximately 72 inches annually) falls during the rainy season.

Less than six per cent of all employed laborers were engaged in agricultural activities. As noted in Table 11, corn was not the major crop, for it accounted for less than 40 per cent of all cultivated crops. It was, nevertheless, the most important subsistence product. Large land holdings

Table II
Graphical and Statistical Information on
Towns and Villages of Group A

PLACE	ALTITUDE (FEET)	DISTANCE FROM CAPITAL (MILES)	TRANSPORTATION AVAILABLE	COMMUNICATIONS
Concepcion Chiquirichapa	8,485	138	Bus service daily to Quezaltenango and nearby villages	Postal service, telephone
San Antonio Palopo	5,438	79	Foot path to other lake villages	Postal service, telephone
San Antonio La Paz	4,177	30	Bus service daily to Guatemala City	Postal service, telephone, telegraph
Puerto San Jose	20	76	Bus, train service daily to Guatemala City	Postal service, telephone, telegraph
La Democracia	307	60	Bus service daily to Guatemala City	Postal service, telephone, telegraph

Graphical and Statistical Information on
Towns and Villages of Group B

Agueacatan	5,228	210	Bus service daily to Guatemala City and Quezaltenango	Postal service, telephone, telegraph
Chichicastenango	6,447	104	Bus service daily to Guatemala City and Quezaltenango	Postal service, telephone, telegraph
San Vincente Pacaya	5,082	30	Bus service daily to Guatemala City	Postal service, telephone
San Pedro Carcha	4,185	161	Bus service to near-by villages	Postal service, telephone, telegraph

POPULATION									
TOTAL	MALE	FEMALE	INDIAN	LADINO	CHILDREN UNDER 6 YEARS	NO. OF FAMILIES	NO. OF PEOPLE EMPLOYED OVER 7 YEARS	NO. OF FARM LABORERS	NO. OF NON-FARM LABORERS
1,188	488	700	1,082	104	187	282	462	432	30
870	428	442	868	2	125	192	410	385	25
803	338	465	0	803	107	152	381	347	34
3,288	1,516	1,752	66	3,172	302	572	1,057	222	835
1,517	650	867	43	1,464	196	242	512	492	20
796	388	408	286	510	174	202	427	152	275
1,889	748	1,121	1,012	867	260	409	672	419	153
3,521	1,702	1,819	0	3,521	343	507	457	420	17
3,280	1,368	1,892	1,480	1,830	529	740	1,370	950	420

AGRICULTURE													
TOTAL ARABLE ACREAGE	ACREAGE IN CROPS	ACREAGE IN FALLOW	ACREAGE IN PASTURE	ACREAGE IN FOREST	NO. OF FARMS	SIZE OF FARMS (ACRES)	ACREAGE IN CEREALS			LEGUMES		VEGETABLES	TREE CULTURE
							CORN	WHEAT	OTHERS	BEANS	OTHERS		
1,277	1,105	90	82	260	408	0.3 to over 6. Av. 2.8	433	220	Oats 10		Broadbean 170	Potatoes 210	Peach 2000 Apple 150
2,522	2,522	0	0	0	805	3.5	2,300	45	0	60	0	Onions, chiles, tomatoes, onion 100 total	Peach 125 Avocado 100 Guava 56
1,602	1,400	155	47	340	282	0.5 to over 15 Av. 4	1,080	0	0	210	0	Yucca 35 Tomatoes 25 Chiles 10	Avocado 80 Orange 175 Peach 50 Coffee 500 Banana 425
5,900	2,000	1,000	2,500	200	67	2.5 to over 1,000. Av. 6.2	690	0	Rice 80	120	0	Squash 15 Tomatoes 40	Coconut 2,000 Banana 400 Orange 270 Lemon 200 Breadfruit 100
7,270	5,100	1,200	800	170	251	2 to over 700 Av. 30	1,900	0	Rice 700	75		Tomatoes 75 Onions 20	Avocado 400 Coconut 350 Orange 300 Plantain 200 Banana 200
795	400	105	190	110	152	0.4 to over 10. Av. 4	170	0	0	55	0	Garlic 50 Onions 50 Tomatoes 20 Beets 15 Cabbage 15 Radishes 10 Lettuce 15	Lime 2000 Lemon 500 Avocado 350 Orange 700 Peach 300 Plum 100 Coffee 650 Banana 250
2,160	1,185	350	100	525	337	0.2 to over 20 Av. 2	800	130	0	70	Broadbean 25	Squash 25 Potatoes 75 Tomatoes 25	Apple 700 Avocado 2000 Peach 2500 Plum 900 Orange 150
600	455	55	25	70	108	2 to over 20 Av. 2.5	300	0	0	110	0	Tomatoes 10 Onions 10 Squash 5	Avocado 4000 Orange 800 Peach 300
2,380	690	850	400	380	224	1 to over 200 Av. 5	400	0	0	65	0	Tomatoes 5 Onions 10 Cabbage 10 Squash 10	Avocado 800 Orange 900 Peach 1000 Plum 100 Coffee 2,800

NUMBER OF LIVESTOCK												
CATTLE			HORSES	MULES	BURROS	HOGS	SHEEP	GOATS	POULTRY			
MILCH	NON-MILCH	OXEN							CHICKENS	HENS	TURKEYS	DUCKS
47	40	0	72	110	17	75	1740	0	380	252	140	125
0	0	0	15	22	0	12	0	0	85	107	43	12
12	15	27	82	36	30	40	0	10	275	310	35	26
307	814	34	153	50	0	240	0	0	1,000	1,500	210	65
225	400	75	78	42	0	210	0	0	750	900	57	90
103	185	87	27	0	0	80	467	0	200	340	62	35
30	45	0	25	36	15	40	561	25	300	500	80	47
20	24	0	86	57	0	217	0	85	1000	1000	25	115
85	147	22	37	15	0	337	0	0	2000	1,500	400	125

HOUSE TYPES						UTILITIES	SANITATION	COMMUNITY SERVICES	BASIC ECONOMY
TOTAL NUMBER	NO. OF ROOMS	ROOF MATERIAL	WALL CONSTRUCTION	FLOOR	VENTILATION				
283	1–2	Tile	Adobe	Dirt	No chimneys, 1 window per room 1 door per house	No running water, electricity in only 22 houses	No indoor toilet facilities, no garbage disposal	Commercial Educational Religious	Commercial
207	1	Grass thatched	Adobe	Dirt	No chimneys, 2–3 windows per house, 1 door per house	No running water or electricity	No indoor toilets, no garbage disposal, inadequate food storage	Educational Religious	Subsistence
128	1–3	Tile	Adobe	Dirt	No chimneys, 1 window per room 1 door per room	No running water, or electricity	Only 27 outdoor toilets, no walls, many rodents	Commercial Educational Religious	Subsistence
480	2–3	Grass or palm thatched	Vertical poles, cane, grass or palm leaves, wood boards	Dirt	No chimneys, 2 windows per house. 1 door per house	No running water, electricity in only 27 houses	17 indoor toilets, no garbage disposal, numerous insects and rodents	Administrative Commercial Educational Medical Religious	Commercial
212	2–3	Galvanized sheet-iron, grass thatched	Wood boards	Dirt	No chimneys, 2 windows per house. 1 door per house	Running water in 12 houses, electricity in only 18 houses	No indoor toilets, no garbage disposal, numerous insects and rodents	Commercial Educational Medical Religious	Commercial
182	1–4 Av 2	Tile Cement	Adobe	Dirt Cement	1 window per room, 1 door per room, no chimney	No running water or electricity	No indoor toilets, no garbage disposal, 125 wells adjacent to houses	Commercial Educational Religious	Commercial
460	1–8 Av. 2	Tile	Adobe	Dirt Cement	1 window per room, 1 door per room, no chimney	47 houses have electricity, 64 houses have running water	32 houses have indoor toilets, no wells, 180 houses have no toilet facilities	Commercial Dormitory Educational Medical Religious	Commercial
582	1–3 Av. 2	Tile, grass, corrugated sheet iron	Poles, adobe, grass palm leaves	Dirt	1 door per room, windows absent, no chimney	No running water or electricity	No indoor toilets, no garbage disposal or wells	Commercial Educational Medical Religious	Subsistence
679	1–3 Av 2	Straw, grass	Wood boards, poles	Dirt	1 window per room, 1 door per room, no chimney	194 houses have electricity, 64 houses have running water	33 houses have indoor toilets, 187 houses have no toilet facilities	Commercial Educational Religious	Commercial

had severely limited the acreage available for cultivation by the small farmer. There were three plantings of corn; the first two were during the rainy season and the third was in December. The first crop, yielding the greatest harvest, was planted in May and picked at the end of July. The second crop, marked by a smaller yield (16.4 bushels per acre as compared to 18 bushels per acre), was planted in August and harvested at the termination of the rainy period. A third planting was made in December, but was restricted to very humid depressions. Picking took place in February and the yield was approximately 13 bushels per acre.

Corn surpluses entered into the Central Highlands - Pacific Coastal Lowlands corn exchange. A considerable quantity of the corn was sold to the large plantations and estates to feed the thousands of itinerant Highland Indian laborers. Corn picked between August and October was shipped to Central Highland markets to offset shortages which occurred before harvest time.

Virtually from the time of the Spanish conquest, the park-savanna vegetation has been used for the grazing of cattle. Several large ranches or "estancias" own thousands of acres of pasture adjacent to San Jose. During the past few years, these ranches planted an ever increasing amount of artificial pasturage, due primarily to the successful adaptation of sacate, a domestic grass, to the coastal lowland environment.

The majority of the cattle (Zebu, Brown Polle, Shorthorn) were owned by the large ranches. In addition to raising their own animals,

ranchers bought emaciated cattle stock which were fattened prior to being sold in Highland markets. Dairying has increased, but milk production was low due to disease, lack of pasturage during the dry season, and the absence of silage facilities. Cattle production and dairying was at a low level of technical development. Very little attention was given to breeding, tick and disease control, and sanitation.

In the past five years, owners of large plantations, controlling extensive land holdings close to San Jose, have planted several thousand acres of cotton. High prices and an increased cotton industry in Guatemala, have stimulated development in this commercial, but speculative enterprise. Farming methods were largely mechanized and hand labor was kept to a minimum; production methods involved the use of modern machinery and tools, fertilizers, and certified seed.

The majority of the employed laborers were engaged in services, mainly stevedoring which normally required the daily services of 500 men. There were five to seven ships weekly and depending upon the amount of freight, unloading was a continual activity, including evenings and weekends.

The Pacific Coast of Guatemala has a long, steep shoreline; it is noted for its regular features and shallow water. Due to these obstacles, ships are required to be unloaded in deep water. Freight is placed in lighters that transport the cargo to a long wooden pier. Raised by cranes, the freight is then placed aboard rail and truck to be transferred to its ultimate destination. These activities require a large and steady labor force (500 men).

Regular workers are paid 20 cents per hour for a 40-hour week; those workers who operate cranes or are engaged in a more specialized activity receive 30 to 35 cents per hour.

San Jose was one of the leading producers of salt in the country. Large plots of ground were periodically flooded by sea water, from which a fine white salt was obtained by evaporating sea water in basins exposed to the sun. As many as 340 men were employed by this industry, receiving 90 cents for an eight-hour day. Almost the entire production, except for what was sold locally, was shipped via rail to Guatemala City.

Government bureaucracy has prevented the development of a commercial fishing industry. In waters abounding with Catfish, Yellow Croaker, Jackfish, and Spanish Mackeral, commercial fishing was carried on by only one man. His activities were restricted to the days when there were no ships to be unloaded. Night fishing was not permitted. These restrictions, enforced by the army officer in charge of customs, were supposedly designed to prevent smuggling. No nets or seines were used, only hand lines. The average catch, taken in this manner, was small, often less than 100 pounds. All fish sold in local stores was either smoked or dried; a few peddlers sold fresh fish, but the price (30 to 40 cents per pound) was generally prohibitive for most of the villagers.

The increased import of foreign goods, the growth of the salt industry, its rail and road communications with the Central Highlands, and the development of a commercial agriculture in the coastal lowlands have

stimulated the growth of San Jose and its numerous commercial services. As many as 80 businesses provided a variety of services and products; 30 of them were owned by Chinese. Since the completion of the paved highway linking the port to the capital, San Jose has become a popular weekend resort for swimming and deep-sea fishing.

Unfortunately, very little has been done to improve housing and sanitation. Because the soils were sandy and alluvial in nature, there was a general lack of construction material for houses. Due to the high temperatures and humidity, most houses were constructed with open spaces between roof and wall materials. In spite of this device, the majority of dwellings were damp, improperly ventilated and overcrowded. Cooking and eating quarters were generally open, protected by only a roof (Figure 23).

The storage of food, water, and farm surpluses was inadequate and there was virtually no protection against insects, rodents, and animals. Drinking water was obtained from five municipally operated wells. During the rainy season, the majority of the streets and paths were muddy and often impassable. Toilet facilities, when present, were completely unsanitary and were used by as many as five families.

Medical facilities were present; a maternity and infant center was staffed, and maintained by the Public Health Department. Dental services were rendered by a dentist who came from Guatemala City once a week. Medicines were sold in the town's five drug stores, as well as in the daily market.

Although a variety of agricultural products, meat, milk and cheese, bread, and fruits, were offered for sale in the market and stores, the typical diet was monotonously the same, tortillas, beans, and black coffee. Tomatoes and chiles were the most commonly consumed vegetables, but they were not eaten regularly. Milk, when purchased, was bought by the glass and carried in an open container from the market to the house.

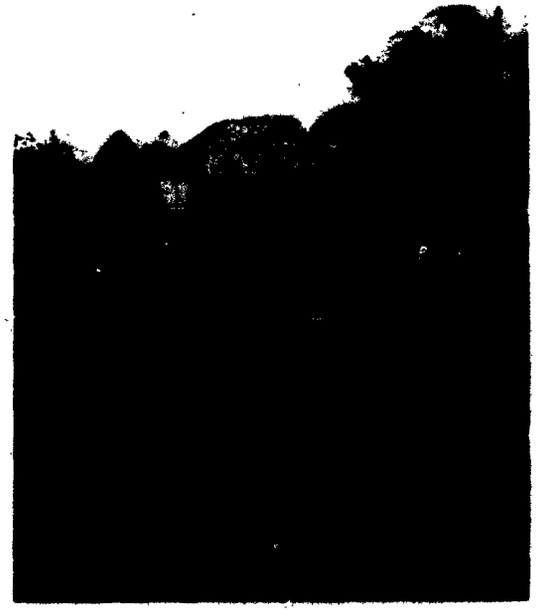


Figure 23

Characteristic houses and street conditions in San Jose.

La Democracia: An almost all-Ladino village, La Democracia (Figure 1) is located on a level plain sloping gradually towards the Pacific.

Although a considerable portion of the arable land is eroded, the soils are considered to be among the finest in the country. Friable and fertile, they are derived from both deep accumulations of volcanic material and alluvial deposits.

At its low elevation (Table 11), high temperatures were continuous. The annual daily temperature averaged 80° F; the daily maximum and minimum temperatures were 95° F and 68° F, respectively. Variations, due to seasonal changes, were small. Precipitation was abundant; the annual total was from 80 to 100 inches. Rain fell mainly during the afternoon and accumulations of more than 10 inches within a 12-hour period were not unusual.

Tenantries were numerous; almost 50 per cent of all farms operated were rented by the villagers at $50 per acre per year. Corn was the principal crop of the small farmers and was planted three times per year. The amount of corn acreage decreased with planting; 1,500 acres, the first planting; 1,200, the second; and 780, the third. There was considerable variation in the time of planting and harvesting. December was the most popular month for planting, April, for harvesting.

Corn yields averaged 15 bushels per acre. When two or three crops were planted consecutively on the same land, the total annual yield was 35 to 40 bushels per acre. Yields increased with the size of the farm; highest yields were obtained on the larger farms, lowest on the smaller farms. On all farms, regardless of size, the second crop yielded more than the first.

Rice was the small farmer's chief cash crop. It was grown on almost all of the farms, except the very smallest. The rice was the upland type

and was not flooded. It was planted in March or April and harvested in late June or early July.

Sacate grass, raised in limited amounts by the farmer, was used either as feed for stock or sold to the large farms and ranches (Figure 24).

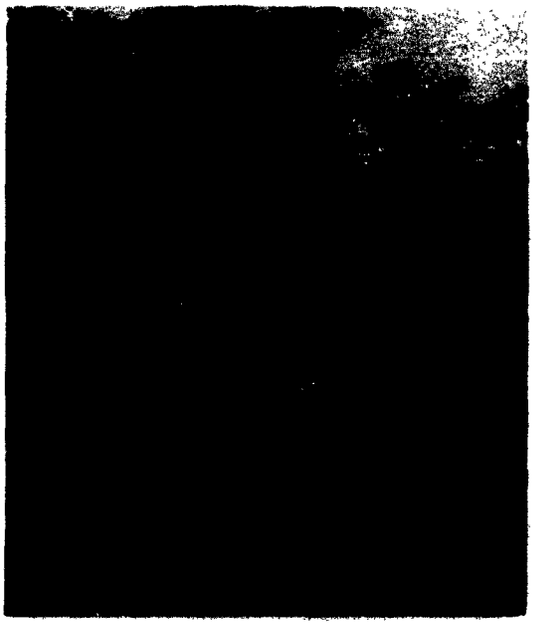


Figure 24

A small planted area of sacate grass and undisturbed vegetation in background.

Tomatoes and onions, approximately 100 acres of each, were produced chiefly for commercial purposes. These vegetables, along with avocados, coconuts, pineapples, and plantains, were raised by all farmers and sold in Guatemala City.

The large farms (fincas) and raches that made up the majority of the arable land in this section of the Pacific Piedmont were engaged in commercial activities. Cotton, citronella, and lemon grass were grown in large quantities. Since irrigation was not used, it was essential that the crops raised were adaptable to the wet-dry precipitation pattern. In addition to sacate grass, the ranchers planted 70 to 80 acres of corn which was used to feed their laborers. Farms and ranches that had extensive forests, earned additional income from lumbering; the products (board lumber and firewood) were sold in Escuintla and Guatemala City.

Transportation to these markets and adjacent smaller villages was difficult throughout the entire year. During the rainy season, dirt roads and foot-paths were impassable. Floods were common in the region and extensive areas of arable land were frequently inundated.

Besides being faced with the usual problems of sanitation, innutrition, and disease, the village had a serious housing shortage. The shortage was evident when one observed the overcrowding and lack of space in almost all dwellings. The kitchen was frequently used for additional dormitory space and half of the villagers slept on dirt floors.

Almost half of the dwellings were rented; the monthly rental varied from three to six dollars, depending upon the number of rooms and size of the yard. Facilities, such as toilet and well, were often completely lacking in the rented houses. Private owned dwellings were generally in a better condition, having more adequate facilities, but were as unsanitary as rented units. Human and animal excrement was observed throughout the

village. Inadequate storage of corn and rice was responsible for rodents and small animals which plagued the villagers.

The medical needs of La Democracia were met at a modern four bed clinic and dispensary built in the village by the Rural Public Health Service. Staffed with medical officer and nurse, this clinic served not only the villagers, but also the smaller rural settlements in the vicinity.

A large number of the employed males worked for daily wages on the large farms and ranches. The average laborer received 60 cents per day, while more skilled laborers were paid as much as one dollar per day. The majority of earned income was spent on food and rent, since these laborers rented houses. Corn, beans, and coffee were the most commonly purchased commodities that were consumed in any quantity. Small amounts of rice and vegetables were added to the diet. Meals were prepared on a wood fire which was elevated off the ground (Figure 25).

Group B. Four villages were investigated in this group; each reported that 30 per cent of all deaths had occurred among children under the age of six.

Aquacatan "The place of abundant avocados," Aquacatan serves as a trade and religious center for a dispersed population. Established shortly after the Spanish conquest, the village was once noted for its productive gold mines. Today, its mixed Indian-Ladino population is one of the most successful commercial agricultural settlements in Guatemala.

Situated in a small valley at the base of the steep southern side of

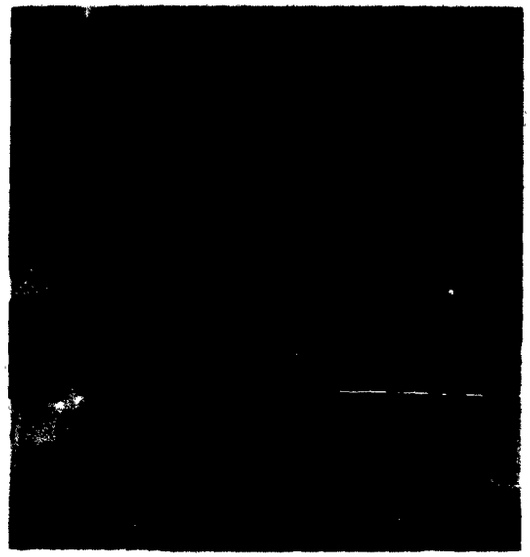


Figure 25

Typical cooking area in a Ladino house in La Democracia.

the Cuchumatanes Mountains, Aquacatan (Figure 1) lies between the River Negro and the foothills of the mountains (Figure 26). The site of the village marks the greatest width of the valley, which is only three miles. It is seven miles long. Reaching to some of the highest elevations in Central America, these adjacent mountains, composed of dolomites and limestones, have an extraordinarily rugged and deeply dissected surface.

At the higher elevations, the vegetation was mixed pine forest and coarse grass (Figure 27). Above 10,000 feet, the smooth summit areas of the Cuchumatanes were cool and frequently obscured by clouds and mists. The landscape was one of scattered forests (cypress, pines, and junipers), alpine meadows were numerous.

In comparison with the Central Highlands, the temperature was low, varying from 41° to 59° F. At Aquacatan, temperatures were higher (46° - 77° F) due to a lower elevation, but during December and January, temperatures occasionally dropped as low as 32° F in the early morning.

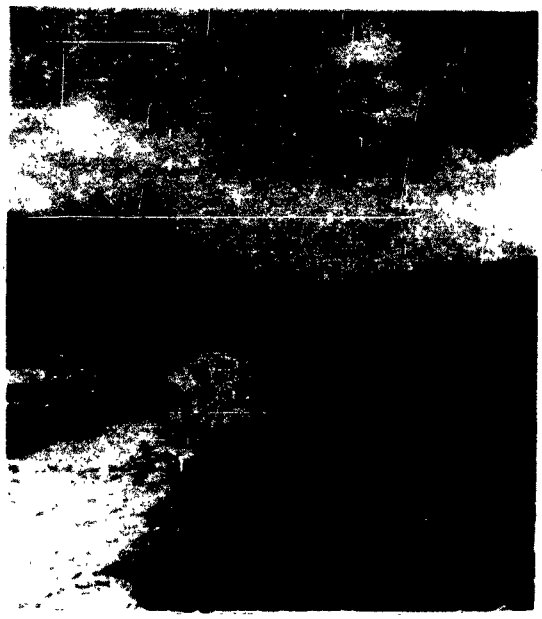


Figure 26

The River Buca and the intermountain valley in which Aquacatan is located.

Snow had fallen on the higher peaks in the region.

Both subsistence and commercial crops were raised (Table 11), but the increasing demand for a greater variety of cash crops has continually reduced the subsistence acreage. Almost all the arable land was restricted to the valley, with a small amount found on the lower, gentler slopes of the foothills. Less than 50 per cent of all crops were subsistence and the amount has continued to decline annually.

Corn fields were cultivated for 10 to 15 years, or until the yield declined excessively; fields were then left fallow for as long as five years. Beans were interplanted between rows of corn and the annual rotation of

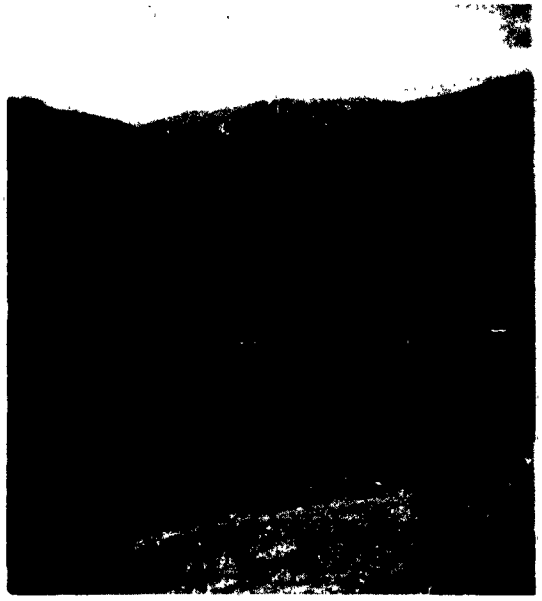


Figure 27

Forest and grass vegetation and occasional small farm of the Cuchumatanes Mountains.

these crops was common. Although all commercial crops were fertilized extensively, corn and beans received only small amounts, if any. Fertilizer for subsistence products consisted mainly of corn leaves, pine needles, and animal manures.

The traditional hoe and pick were supplemented by machetes and oxdrawn metal plows. Numerous rivers and springs that emerged at the

base of the Cuchumatanes Mountains were diverted to create one of the few irrigational systems in the entire country (Figure 28). Irrigation, terracing, fertilization, and crop rotation have resulted not only in higher corn yields than in other highland areas (27 as compared to 20 bushels per acre), but had also established Aquacatan as one of the leading vegetable producing areas in the country.

The village is noted for its garlic production, its most important cash crop. Onions, like garlic, are grown in irrigated, fertilized garden plots (Figure 29). In addition, a variety of vegetables are produced for sale in Huehuetenango and Quezeltenango. Garlic is sold throughout the country. Numerous fruits are picked and sold in the larger urban markets.

Animal husbandry was a secondary activity, but provided the villagers

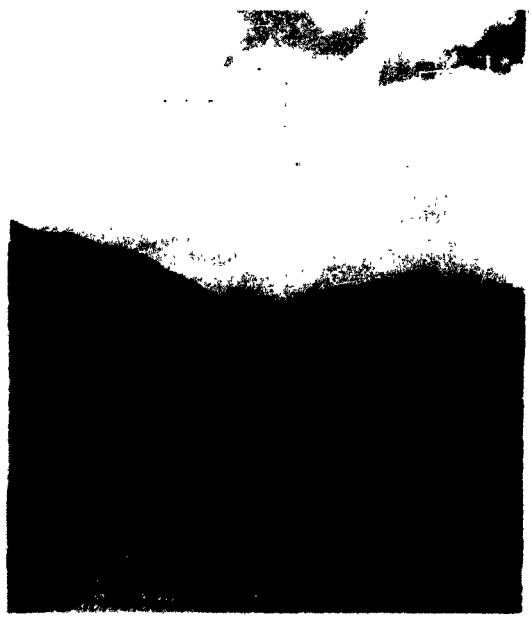


Figure 28

Corn cultivation and irrigation at Aquacatan. Note eroded and gullied foothills and Cuchumatanes Mountains in the background.

with an additional source of income. Sheep were grazed in the higher elevations while cattle were restricted to the foothills. Poultry were plentiful and well fed.

The majority of the non-farm laborers produced baskets. Almost every family was engaged in this cottage-type industry, making over 100 dozen in a variety of sizes and shapes. These were shipped throughout the country; the majority were sold in Guatemala City.

Aquacatan was built to conform to its physical setting. Focus was on the small square, which served as the site for the weekly market. The majority of the stores were located on the main street, facing the river, where a variety of items were sold and numerous services, such as the

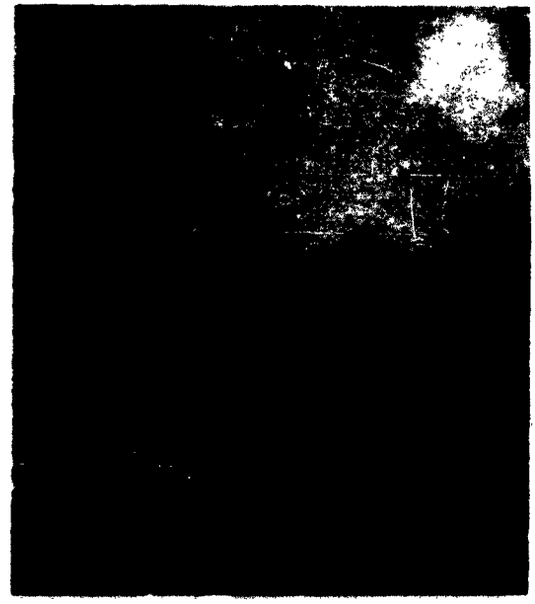


Figure 29

Man-made terraces and irrigated intensive agriculture in Aquacatan.

grinding of corn, were offered. The vendors in the market were principally Indians who resided in small villages at the higher elevations. The items they offered for sale were firewood, potatoes, fruit, and vegetables.

Each house had a well which generally was located between the outdoor toilet facilities and the dwelling. The small adjoining yard was used to raise corn and beans and to confine animals at night.

No medical facilities were available. A limited supply of medicines were kept by the village priest who also administered a milk program. The mayor and a Ladino storekeeper gave injections of antibiotics and dispensed drugs to sick villagers who could afford their services.

Even though the farmers of Aquacatan were noted for the variety, quality, and quantity of cash crops which they raised on a relatively limited area of land, they did little to improve their living conditions. Sanitation was lacking, wells were contaminated, farm animals had ready access to cooking and sleeping quarters, and rodents were numerous. The diet was characteristically tortillas, beans, and black coffee. A few vegetables, but practically no meat, eggs, and milk were consumed. Drunkenness, observed in the other villages and towns, was prevalent and unfortunately was, in part, responsible for reducing the money available for purchase of basic food-items.

Chichicastenango: One of the most interesting and colorful towns in Guatemala, Chichicastenango (Figure 1), with its large market and colonial church, is one of the country's chief tourist attractions. Located in the Central Highlands, the town is in an area of numerous, steeply eroded ravines. Rocky, untillable, forest mountainsides dominate the landscape. Extensive stands of oak and pine are found at this elevation, but at higher altitudes the trees change to spruce and cypress.

Approximately 70 per cent of the working population were agriculturists. Corn was the leading subsistence crop, accounting for three-fourths of all cultivated crops. It was grown on small farms without the benefit of rotation, fertilization, terracing, or contouring. Yields were low, varying from 10 to 18 bushels per acre.

Wheat was raised as a commercial crop, but the total acreage and yield was small. Beans, potatoes, and a few vegetables constituted secondary subsistence crops. Fruit, of which a large variety grew in the region, was picked and sold.

The lack of pasturage and supplementary feed has limited animal husbandry. Milch cows were more numerous than beef cattle; mules and horses were used primarily as beasts of burden. Sheep were numerous and were grazed on alpine meadows located at higher altitudes. Poultry, especially chickens and hens, were plentiful.

Trade and religious activities brought the inhabitants of many regions to Chichicastenango. More than 5,000 people took part, biweekly, in market activities and made it one of the outstanding sights in the country (Figure 30).

In addition to tourist hotels, there were several hundred houses that served as temporary residences for the itinerant merchants and market visitors. Whereas the villages and towns of the Piedmont and Coastal Lowlands were faced with severe housing shortages, Chichicastenango had many vacant houses. A number of stores, including 64 bars, offered a variety of services.

The adverse physical conditions and small farm holdings did not allow the villagers to raise sufficient crops to meet their own needs. In an

effort to obtain money, Indians worked as itinerant laborers on the large farms and plantations in the lowlands. Ladinos were more active in services and commercial enterprises; many were vendors, selling items that came from the looms of Chichicastenango women. There was one mill in the town which made flour and employed five persons, all Ladinos.

Figure 30

The open market at Chichicastenango, the largest in the country.

Medical facilities and services were provided by the Rural Public Health Service, Catholic Church, Protestant missionary, and Bahi missionary. The clergymen, though not physicians, had some medical training; their dispensaries were well stocked with a variety of medicines.

San Vicente Pacaya: Located in a small valley in the upper Pacific Piedmont, San Vicente Pacaya (Figure 1) faced the high and steeply eroded foothills of the southwestern Central Highlands. Much of the land owned by the villagers was in varying degrees of erosion. The removal of the forests, a heavy orographic precipitation during the rainy season, and a friable volcanic soil were responsible for extensive destruction of much of the arable land. Innumerable straight, parallel small streams, flowing down from the Central Highlands between narrow ridges, made access to the village difficult.

Where the vegetation had not been thinned or removed, the forest was thick. Trees were immense, having large trunks, great heights, and extensive spreading branches. Luxuriantly growing, woody vines and lianas matted the tree foliage. The air was damp and cool.

Not only the best land, but the majority of all arable land, is owned or controlled by the large farms and plantations. The land, utilized by the villagers for subsistence agriculture, is submarginal compared to the holdings of the private estates.

The total cultivated acreage was small, only 433 acres. Farming was entirely subsistence and on a very restricted scale. Corn was planted in small, steep rocky plots, yields were low (Figure 31). Beans were planted either separately or between the rows of corn. A small quantity of vegetables was grown, solely for local consumption.

Fruit trees provided the farmers with their only commercial agricultural product. The thousands of avocado trees picked by the villagers

made San Vicente Pacaya one of the major avocado regions in Guatemala.

Again, the shortage of pasturage and feed has limited animal husbandry to small animals. Pigs and poultry were abundant and were

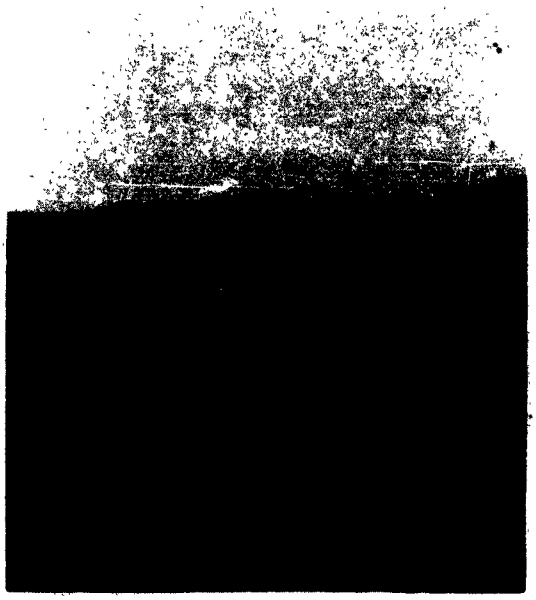


Figure 31

Typical corn field and steep slopes near San Vicente Pacaya

sold in the larger settlements. The large number of horses and mules were used by the laborers employed by the privage estates as a means of transportation.

It was impossible for the small farmers to raise a crop in any quantity. All of the steadily employed laborers worked on the coffee plantations near Lake Amatitlan. These workers earned an average wage of 60 to 75 cents per day. They received, in addition, a ration of corn and

beans. During harvest, when a large labor force was required, the majority of the women and children accompanied the men. Their services were required mainly between October and December and they were paid according to the amount of coffee picked.

San Vicente Pacaya's main function was to provide dormitory space. The principal income of all residents was derived from the coffee plantations; their subsistence agriculture was secondary. The village was large, but was focused on the large central square. The church was the most outstanding landmark in the village and was served by a resident priest whose parish was in Amatitlan.

It was difficult to determine whether a family was Ladino or Indian. Except for attire, the houses, dietary habits, and superstitions, all the Ladino villagers were the same as those observed in Indian villages. The standard of living was very low.

Houses were constructed to afford maximum ventilation, but they were constantly damp (Figure 32). There were no wells in the village and water had to be obtained from nearby springs and streams. The yards and home gardens worked by the women were larger than those observed in other villages and towns.

The new dispensary built by the Rural Public Health Service performed admirable services. Staffed by three nurses and visited weekly by a physician, this unit was a working example of what could be done to improve the life of the Guatemalan. Accurate records were kept of all vital statistics and an intensified educational program was in progress.

Instruction was given the local women in sewing, prenatal care, infant welfare, sanitation, and food preparation.

San Pedro Carcha: Lying to the north of the Central Highland, San Pedro Carcha (Figure 1), a commercially active town has a somewhat greater agricultural potential than first observation might suggest. The topography is a complex hill and valley arrangement and much of the region

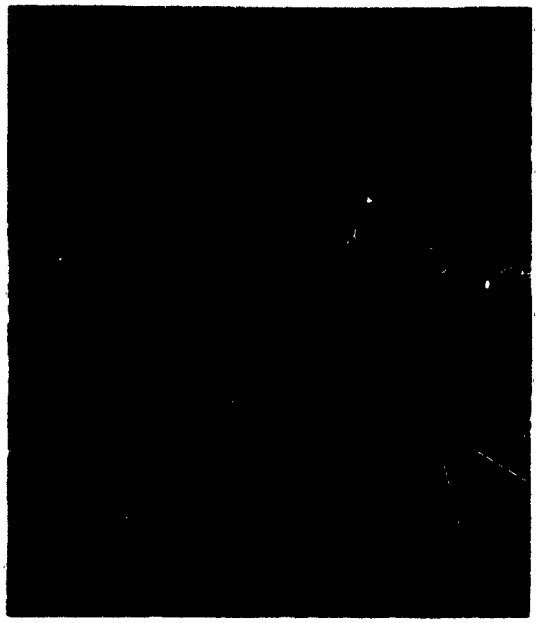


Figure 32

Typical Ladino housing in San Vicente Pacaya.

is in steep slope. The soils, derived from sedimentary rocks, are generally shallow and unproductive; the best soils are found in valley depressions and on the lower slopes of the hills.

The unusual climatic conditions compensate for the adverse land resources. Caribbean moisture-laden winds produce an abundant, well

distributed rainfall. San Pedro Carcha is seldom dry, except for the less wet months of March and April. The annual relative humidity is high; fogs, mists, and clouds commonly occur and temporarily interrupt air service with other regions of the country. Although it lies above 4,000 feet, the annual temperatures (62^{o} - 72^{o} F) are mild, considering its altitude.

Only one-fifth of all arable land was in subsistence crops. Farming was on a small scale, but most yields were high. Weeds and bush had to be cut frequently and were burned annually. These burnings provided a much needed fertilizer for the fields. Corn yields, although high (20 to 40 bushels per acre) were consumed directly by the farmers and provided little surpluses. Beans and vegetables were secondary subsistence crops.

Although fruits were numerous and provided a cash income, coffee was the chief commercial crop for both small farmer and large plantation owner. Indian coffee production was low and of poor quality, reflecting lack of fertilization, improper harvesting, and haphazard agricultural techniques. Coffee production on the large plantations which were formerly German owned, was also low. Inefficient management, theft, and a lack of initiative, were but a few of the reasons why coffee production had declined since the estates were expropriated during World War II.

Many Ladinos who own large farms have turned to cattle and dairying for a new source of revenue. The town owned several hundred acres of pasturage which were rented to the small farmer at one dollar per month per animal. The larger farms not only left much of their acreage annually in fallow, but planted alfalfa in addition to the natural pasturage. Cattle

herds were not large; milch cows were generally more numerous than beef cattle. All stock appeared well fed and in better condition than those observed in other parts of the country.

Not only were the townspeople engaged in both subsistence and commercial agriculture, but they also took part in a number of commercial activities. Many men, in addition to their own small farms, worked on the large estates, receiving rations of corn, coffee, and salt, besides their daily wage. Five factories and one dairy employed 70 persons. Fireworks and tannery workers earned wages that varied from 60 cents to $1.50 per day. Mining activities were carried on less than 20 miles from San Pedro Carcha. These mines were American owned, but Guatemalan operated. In them as many as 200 men mined lead, zinc, silver, and bauxite. all of which were exported to the United States. Laborers were paid from two to three dollars per day.

One of the major deterents to the agricultural development and expansion of the region is its isolation. There are many truck routes to Guatemala City, but all are over extremely rugged terrain and take as much as 15 hours. There is no direct rail service and unfavorable weather conditions frequently interrupt air flights. What was previously a prosperous and growing market, has now reverted back to the typical Indian exchange. The market, predominately Indian, had little to offer outside of corn and beans; tomatoes, potatoes and a few cucurbits were sold in small amounts.

San Pedro Carcha still reflects the effects of the German settlement. A hydro-electric power plant, built with German ability on the swiftly flowing Chicoy River, supplies electricity for both the town and nearby Coban.

Numerous dwellings have indoor toilets, running water, and adequate ventilation. Houses for permanent laborers, on the estates formerly owned by Germans, are better constructed and more sanitary.

The standard of living, for both Indian and Ladino, was higher than that observed in the other towns and villages. Their own crops, plus the rations of food received as part of their daily wages, enabled the majority of the farmers to be self-sufficient. Income earned from other commercial activities was used to purchase whatever else was required. Although no medical facilities were available, it was less than 10 miles to Coban, where a large government-owned hospital met the medical requirements of the municipality.

CHAPTER VI

ANALYSIS OF INFORMATION ON THE NUTRITIONAL STATUS OF 1,193 PRE-SCHOOL CHILDREN

Physical Examination. A physical examination was performed on 1,193 pre-school children; 562 were from villages and towns of Group A and 631 from villages of Group B. The examination included a search for signs of malnutrition, the clinical diagnosis of specific diseases, the measurement of height and weight, and an appraisal of the general nutritional status.

Signs of Malnutrition. In order to begin the analysis, the 65 signs according to the various regions of the body (Table 12 and Appendix B) were grouped. Enumerated in Appendix B are the total number of times each sign was observed at four levels of intensity in two groups of pre-school children (Group A and B) To make the original data comparable, the incidence of each sign listed in Table 12 has been expressed as number of times per 100. Because the signs in the first column were classified by the examining physicians as doubtful, this column is ignored in the analysis. Inspection of the table brings out the outstanding finding that in both groups the majority of signs were only slightly severe (intensity 2). There was, in either group, a very low frequency of moderate or severe development of these signs.

The next step in the analysis was to segregate the clinical signs into two categories. In the first there were the signs which were closely correlated with independent evidence that the patient was malnourished. In the second category were signs that were not only associated with nutritional deficiency but also with conditions quite unrelated to nutrition.

TABLE 12

REGIONAL SIGNS OF MALNUTRITION GROUPED ACCORDING TO FREQUENCY AND SEVERITY: NUMBER/100

(Degrees of severity: 1 = doubtful, 2 = slight, 3 = moderate, 4 = severe)

Region and Sign Numbers	Number of Signs/ Region	Group A				Group B			
		1	2	3	4	1	2	3	4
Hair (1-2)	2	4.9	9.0	0.5	0.4	1.2	5.3	0.3	0.2
Eyelid (3-5)	3	3.5	25.0	2.8	0.9	1.7	22.9	2.6	0.9
Palpebral Conjunctiva (6-7)	2	7.2	25.2	1.4	0.0	2.0	37.9	3.1	0.0
Bulbar Conjunctiva (8-14)	7	23.6	98.4	9.7	0.5	9.6	111.1	13.2	0.9
Cornea (15-17)	3	8.1	32.5	1.2	0.0	3.9	30.4	1.7	0.0
Face (18-23)	6	7.6	34.8	0.5	0.0	2.2	43.2	1.1	0.0
Lips (24-26)	3	11.3	23.3	1.6	0.5	1.2	9.3	0.3	0.5
Gums (27-30)	4	5.5	35.7	2.8	0.4	1.4	27.8	2.6	0.0
Tongue (31-39)	9	19.0	50.2	4.9	0.2	3.4	36.0	0.8	0.5
Teeth (41-45)	6	7.1	74.8	24.5	11.0	3.1	81.2	23.8	10.4
Mucous Membranes (46)	1	4.6	17.9	1.9	0.9	1.2	10.4	0.8	0.0
Neck (47)	1	1.2	6.5	0.4	0.0	0.3	0.6	0.0	0.0
Abdomen (58)	1	2.8	19.9	1.4	0.0	0.5	18.2	1.4	0.0
Skin (49-57)	9	5.3	16.0	2.4	0.9	6.0	43.4	3.7	0.5
Nails (59-60)	2	3.5	9.6	0.9	0.0	0.9	12.1	0.5	0.5
Skeleton (61-62)	2	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.3
Nervous System (63-64)	2	0.5	1.6	0.9	0.7	0.5	1.8	0.6	1.1
Subcutaneous Tissue (65)	1	1.0	1.4	0.9	0.2	0.2	1.1	0.2	0.5

In this non-specific group were also signs the etiology of which is unknown.

The signs which were included in the first group were those which long experience of the clinical nutritional research at INCAP had shown to be most indicative of malnutrition. This group included the two flag signs of the hair (1 and 2), hypertrophy of the papillae of the tongue (35 and 36), pallor of the mucous membranes (46), hypertrophy of the parotid glands (47), such dermal conditions as acrocyanosis, pellagroid erythema, intertrigo, and hypertrophy (52 to 56), cranio-tabes (61), diaphyseal-epiphyseal widening (62), altered reflexes (63), loss of vibratory sensation (64) and edema (65). The majority of the remaining signs -eyelid (3 to 5), palpebral conjunctiva (6 and 7), bulbar conjunctiva (8 to 14), cornea (15 to 17), face (18 to 23), lips (24 to 26), gums (27 to 30), teeth (41 to 45), abdomen (58), nails (59 and 60) - were of a non-specific nature.

On the basis of such a segregation, the signs having the greatest incidence (Table 12), with the single exception of mucous membranes (46), were non-specific. Most prominent in this group were abdomen, teeth, and eyes, and these signs can be more certainly related to other things than nutritional deficiencies. Furthermore, regardless of severity, there was almost an equal frequency distribution of these non-specific signs among the children of Groups A and B. This distribution supports the interpretation that these signs are in fact non-specific, for we would expect, under hypothesis, that there would be more of these signs among Group A children than among Group B, if the signs had a nutritional origin.

In sharp contrast, when studying the signs indicative of malnutrition,

we find that in 15 of 22 possible comparisons, these signs were more common among children of Group A than Group B. Determined by the Chi-Square Test, this difference was significant at the 10 per cent level. This result suggests that there probably was a greater amount of malnutrition among children in Group A than children in Group B.

This conclusion is supported by Table 13 and Appendix C, which shows a higher proportion of kwashiorkor in children of Group A than of Group B. The nutritional deficiencies that are responsible for kwashiorkor are also related to the various signs of malnutrition. On the other hand, goiter is three times as common in children in Group B as in Group A. This condition is thought to be associated with iodine deficiency. Most of Group B villages were located in the highlands and their locations could be responsible for an iodine deficiency. No matter what position is taken with regard to dental caries, the incidence is about the same in both groups. On the basis of Indian versus Ladino, Indian males in Group A had the lowest incidence.

General Nutritional Status. The percentage distribution of the subjects in Groups A and B, among the four categories of nutritional status, has been summarized in Table 14. Study of the table reveals four facts. First, regardless of race, sex, or group, the majority of the subjects could be classified as having "good" or "regular" nutriture. Second, in the "excellent" category were 2.3 per cent of the total subjects of Group A and 5.9 per cent of Group B. Third, in the "bad" category were 7.1 per cent of all subjects in Group A and only 1.4 per cent in Group B. By the Chi-Square Test the distribution of all subjects in Group A was significantly different

TABLE 13

VARIOUS DISEASES OBSERVED IN GROUPS A AND B NUMBER/100

(M = Male; F = Female)

Condition	Group A					Group B				
	Total	Indian		Ladino		Total	Indian		Ladino	
		M	F	M	F					
Caries	216	13.9	27.1	44.8	45.3	231	36.2	38.1	38.8	34.7
Goiter	56	4.6	10.5	10.1	11.8	151	27.5	22.2	26.7	20.4
Kwashiorkor	9	0.0	0.5	1.3	2.5	3	1.7	0.0	0.0	0.8
Starvation	3	0.0	0.5	0.0	1.0	1	1.7	0.0	0.0	0.0
Other Pathology										
Hepatomegaly	15	1.1	0.0	3.2	3.2	3	0.0	0.0	0.8	0.4
Splenomegaly	1	0.0	0.0	0.0	0.5	1	0.0	0.0	0.4	0.0
Diarrhea	0	0.0	0.0	0.0	0.0	3	3.4	0.0	0.0	0.4
Heat Rash	5	0.0	0.0	1.3	1.0	0	0.0	0.0	0.0	0.0
Conjunctivitis	7	1.3	1.3	0.0	0.5	5	1.7	2.4	0.4	0.4
Adenopathy	0	0.0	0.0	0.0	0.0	2	1.7	1.2	0.0	0.0
Ascariasis	0	0.0	0.0	0.0	0.0	2	0.0	0.0	0.4	0.4
Scabies	0	0.0	0.0	0.0	0.0	1	0.0	1.2	0.0	0.0
Eye Infection	1	0.0	0.5	0.0	0.0	2	0.0	2.4	0.0	0.0
Dermatosis of Ear	6	5.8	0.5	0.0	0.0	2	0.0	1.2	0.0	0.4
Hernia	0	0.0	0.0	0.0	0.0	4	1.7	0.0	0.8	0.4

TABLE 14

GENERAL NUTRITIONAL STATUS OF GROUP A AND GROUP B VILLAGES AND TOWNS

Group A	Total No.	Excellent No.	Excellent %	Good No	Good %	Regular No.	Regular %	Bad No.	Bad %
All Subjects	562	13	2.3	350	62.3	159	28.3	40	7.1
All Indians	152	0	0.0	89	56.5	55	36.2	8	5.3
Males	66	0	0.0	50	58.1	50	34.9	6	7.0
Females	86	0	0.0	39	59.1	25	37.9	2	3.0
All Ladinos	410	13	3.2	261	63.7	104	25.4	32	7.8
Males	216	6	2.8	142	65.7	55	25.5	13	6.0
Females	194	7	3.6	119	61.3	49	25.2	19	9.8
Group B									
All Subjects	631	37	5.9	411	65.1	174	27.6	9	1.4
All Indians	139	7	5.0	79	56.8	50	36.0	3	2.2
Males	58	2	3.4	32	55.2	22	37.9	2	3.4
Females	81	5	6.2	47	58.0	28	34.6	1	1.2
All Ladinos	492	30	6.1	332	67.5	124	25.2	6	1.2
Males	239	13	5.4	165	69.0	60	25.1	1	0.4
Females	253	17	6.7	167	66.0	64	25.3	5	2.0

TABLE 15

NUTRITIONAL STATUS OF GROUP A VILLAGES AND TOWNS

Place and Race	Total No.	Excellent No.	Excellent %	Good No.	Good %	Regular No.	Regular %	Bad No.	Bad %
Puerto San Jose (All Ladinos)	156	7	4.5	89	57.1	48	30.8	12	7.7
La Democracia (All Ladinos)	142	6	4.2	76	53.5	45	31.7	15	10.6
SanAntonio La Pax (All Ladinos)	90	0	0.0	72	80.0	13	14.4	5	5.6
San Antonio Palopo	79	0	0.0	30	37.0	42	53.1	7	8.9
Indian	74	0	0.0	29	39.2	38	54.4	7	9.4
Ladino	5	0	0.0	1	20.0	4	80.0	0	0.0
Concepcion	95	0	0.0	83	87.4	11	11.6	1	1.0
Indian	78	0	0.0	66	84.6	11	14.1	1	1.3
Ladino	17	0	0.0	17	100.0	0	0.0	0	0.0

than the distribution of all subjects in Group B ($P < 0.001$). Fourth, the distribution of subjects classified according to race was not appreciably different from the distribution of all subjects. Finally, on examination the relation of sex to nutritional status, we find suggestive evidence that, at least in the "bad" category, Indian females suffered less than Indian males, whereas Ladino females suffered more than Ladino males. In both Groups A and B, a lower percentage of Indian females than males were in the "bad" category, while the reverse situation held for Ladinos.

Nutritional Status of Individual Villages: In Table 15 we have enumerated the percentage distribution of the subjects in the villages and towns of Group A, according to the four categories of nutritional status. An analysis of the table reveals three facts. First, only two villages, Puerto San Jose and La Democracia, had subjects in the "excellent" category. No Indian was rated as "excellent." Second, two villages, Concepcion and San Antonio La Pax, had a smaller percentage of children in the "bad" category (1.0 and 5.6 per cent respectively) than the other three Group A villages. Third, regardless of race, the majority of the subjects could be classified as having "good" or "regular" nutrition. San Antonio La Pax and Concepcion had an appreciably higher percentage of subjects in the "good" category than the other villages. This higher percentage, however, was observed only among Ladinos.

The per cent distribution of the subjects in the villages and towns of Group B has been summarized in Table 16. The table reveals four facts. First, all villages and towns have subjects, both Ladino and Indian, in the "excellent" category. Second, with the exception of San Vicente Pacaya,

there was a greater number of subjects in the "excellent" category than in the "bad" category. Third, according to race, there was a higher percentage of Indians than Ladinos in the "bad" category while the reverse situation held for Ladinos in the "excellent" category. Fourth, regardless of race, the majority of the subjects could be classified as having "good" or "regular" nutriture.

Skinfold Thickness. To analyze the data, an examination was made of the skinfold thickness measurements of the excellent and good nutritional subjects of Groups A and B (Appendix D). Using Chi-Square (X^2) Test, X^2 was 19.68. This result suggested that the difference between the two groups was not significant. We then examined the figures of the regular and bad nutritional subjects of Groups A and B. X^2 was 18.80. The difference between the two groups was not significant.

There seemed to be justification in pooling both Groups A and B according to nutritional status (Appendix D). In Figure 33 is found the frequency distributions of the skinfold thicknesses of both excellent and good nutritional groups and both regular and bad nutritional groups. X^2 was 106.38 ($P < 0.001$). This result was highly significant. Thus, there is good evidence that badly malnourished individuals have thinner skinfold thickness than well-nourished persons. This result suggested that these individuals had less subcutaneous fat, therefore less body fat.[119]

[119] Josef Brozek and Ancel Keys, "Evaluation of leanness-fatness in man: A survey of methods", Nutrition Abstracts and Reviews, Vol. XX, No. 2, October, 1950, pp. 249-251.

TABLE 16

NUTRITIONAL STATUS OF GROUP B
VILLAGES AND TOWNS

Place and Race	Total	Excellent		Good		Regular		Bad	
	No.	No.	%	No.	%	No.	%	No.	%
San Vicente Pacaya (All Ladinos)	226	5	2.2	157	69.4	58	25.7	6	2.7
Chichicastenango	147	14	9.5	83	56.5	49	33.3	1	0.7
Indian	50	3	6.0	23	46.0	23	43.4	1	2.0
Ladino	97	11	11.3	60	62.0	26	27.0	0	0.0
San Pedro Carcha	134	9	6.7	96	71.6	27	20.1	2	1.5
Indian	52	2	3.8	37	71.2	11	21.2	2	3.8
Ladino	82	7	8.5	59	72.0	16	19.5	0	0.0
Aquacatan	124	9	7.3	75	60.5	40	32.3	0	0.0
Indian	37	2	5.4	18	48.6	17	45.9	0	0.0
Ladino	87	7	8.0	57	65.5	23	26.4	0	0.0

Heights and Weights. The anthropometric data of all males and of all females were averaged for each of the six years of age, first for those subjects who had been placed in the excellent and good nutritional groups and, second, for those subjects who had been placed in the regular and bad nutritional groups (Appendix E). In preparing these averages, measurements for both racial groups and all geographical locations were pooled, for a preliminary analysis suggested that these factors had no significant effect upon the height and weight. The mean values for height and weight together with their standard deviations were compared with the growth curves of Iowa children of the pre-school age (Figures 34 and 35).

Study of these figures brings out two important points. First, Guatemalan males and females are significantly lighter and shorter than the Iowa children. Furthermore, these observations suggest that after about age three, Guatemalan children grow at a slower rate than the Iowa children. Since these inferences apply to both the well nourished and poorly nourished children, the only conclusion that one can come to is that the Guatemalan children are different from the Iowa children and the difference is not entirely due to nutritional conditions.

This conclusion raises the question as to whether the Iowa Growth Curves are appropriate to use as a reference standard in studies of the nutritional conditions of Guatemalan children. Staff researchers at INCAP also doubt the validity of using the Iowa standards for comparing the growth of Guatemalan children, since these children, and particularly Indian children, may not have the same growth rate as the American children.[120]

[120] Scrimshaw et al., op. cit., p. 381.

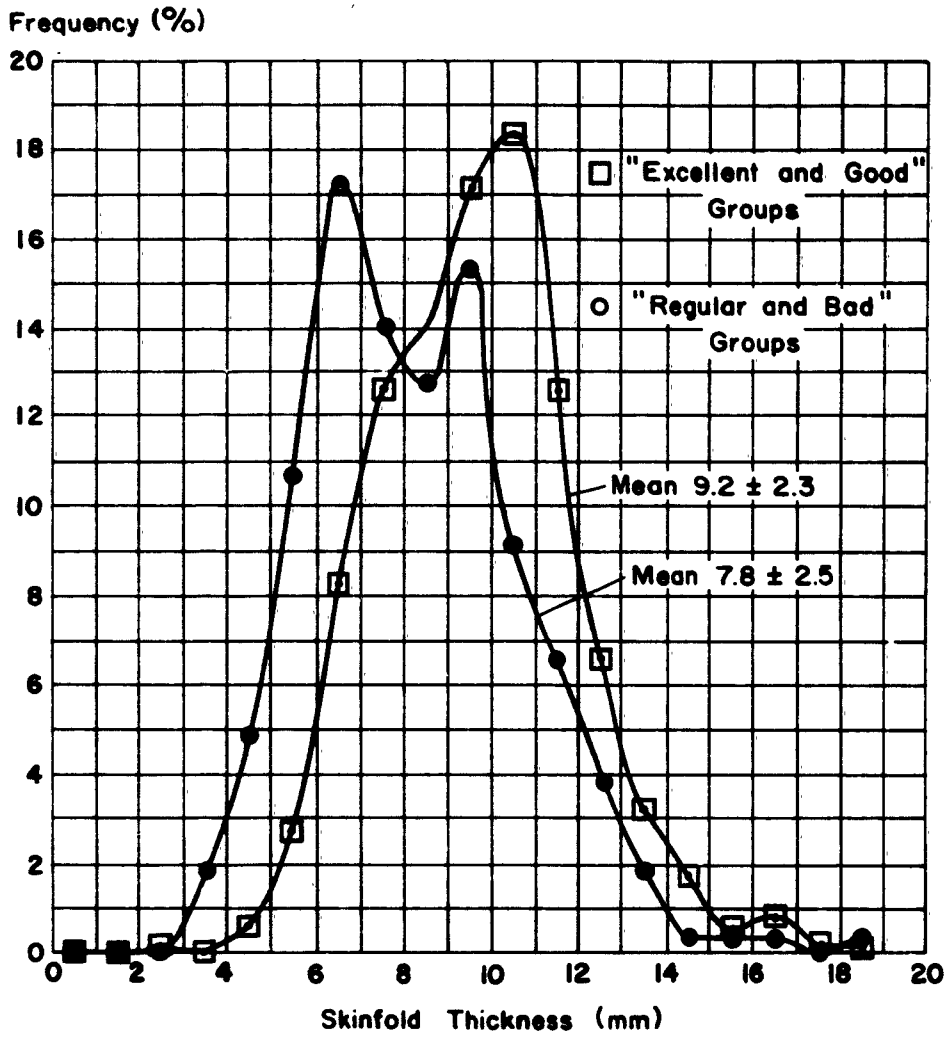
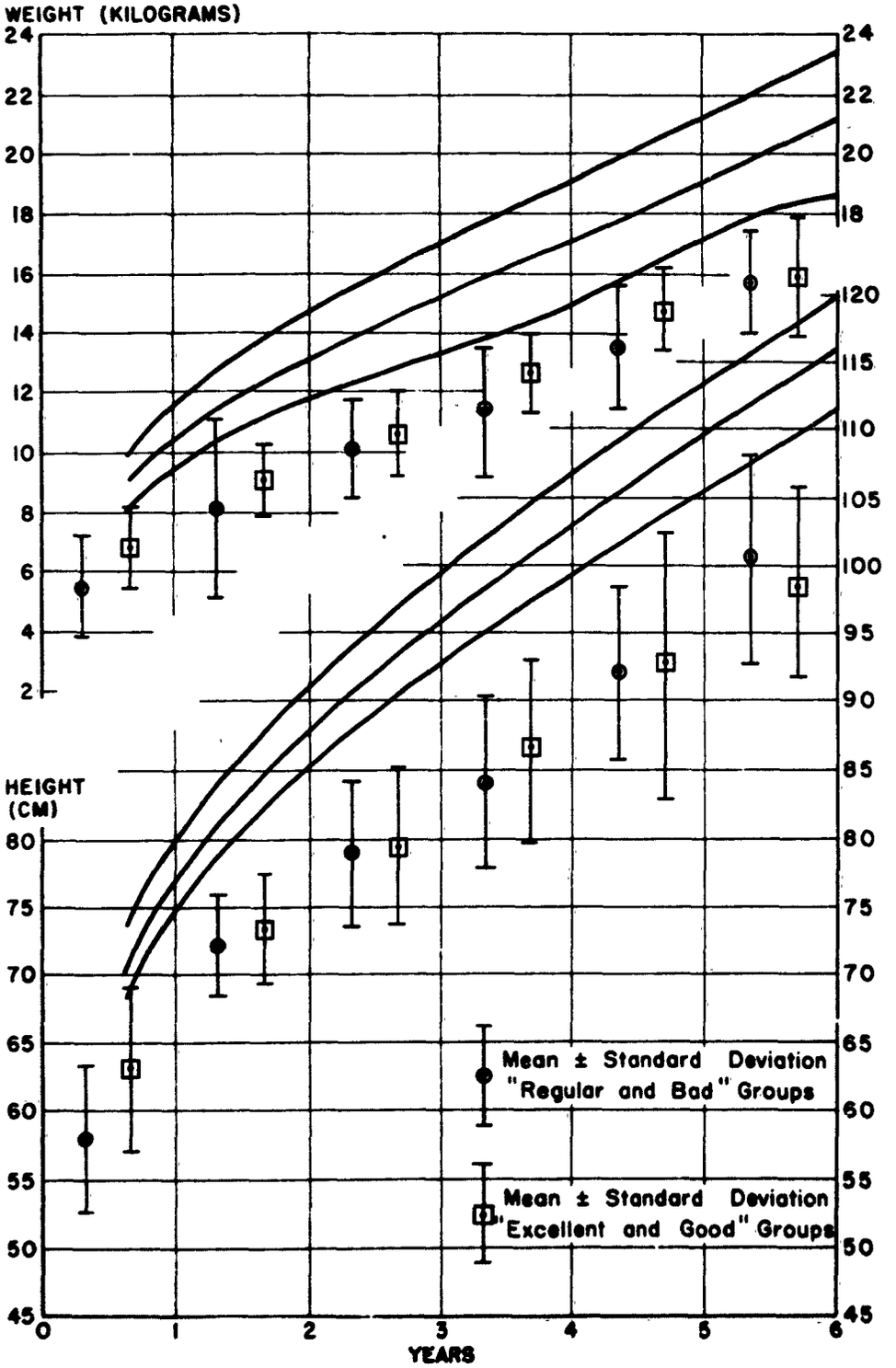


Figure 33

INFLUENCE OF NUTRITIONAL STATUS ON SKINFOLD THICKNESS OF 860 GUATAMALAN PRE-SCHOOL CHILDREN

Figure 34

GROWTH OF GUATEMALAN PRE-SCHOOL CHILDREN
Well Nourished Versus Malnourished Male

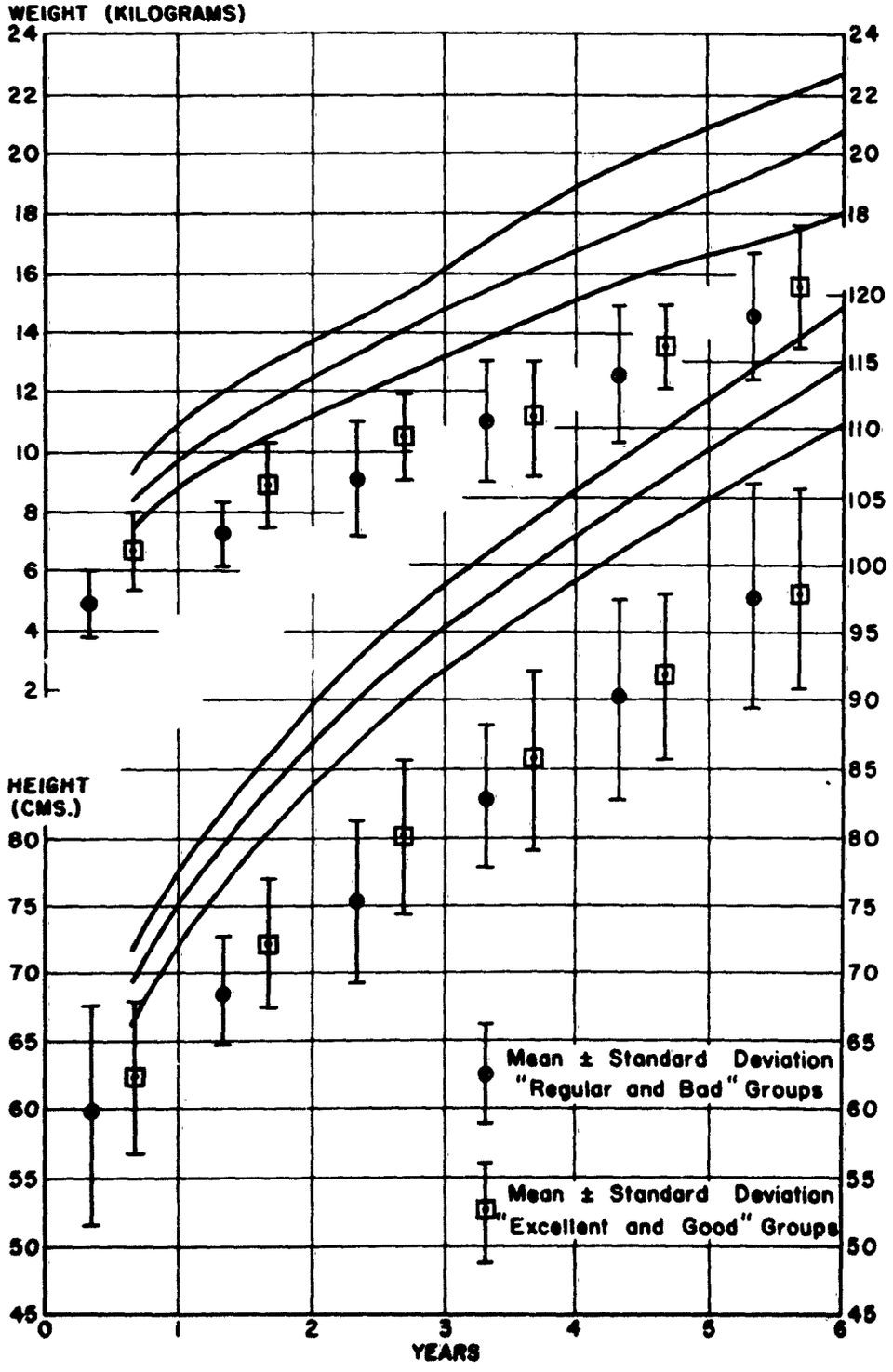


Original charts prepared by the Department of Pediatrics, State University of Iowa, and adapted for use in Central America and Panama by INCAP

Figure 35

GROWTH OF GUATEMALAN PRE-SCHOOL CHILDREN

Well Nourished Versus Malnourished Females



Original charts prepared by the Department of Pediatrics, State University of Iowa, and adopted for use in Central America and Panama by INCAP

Growth studies in Central American countries have disclosed that the degree of retardation is nearly as marked in Costa Rican children of almost entirely European origin as for Guatemalan children with considerable Indian admixture. Unfortunately, no well-nourished Indian group of pre-school children has been available which could be used for comparison. INCAP has conceded the difficulty in attempting to determine the respective parts which the various factors, race, nutrition, and environmental conditions, play in retarding growth, but those workers have expressed the belief that retardation of height and weight is not due to racial causes alone.

An attempt should be made to gather a more extensive series of measurements on well-nourished Guatemalan children to determine with greater precision whether or not the differences that appeared in this investigation are truly representative.

The second outstanding observation concerns differences in growth between the excellent and good nutritional groups and the regular and bad nutritional groups. From an examination of Figures 34 and 35, it is evident that there is a tendency for the poorly nourished individuals to be lighter and shorter than the well-nourished individuals. This difference between the two nutritional groups tends to decrease as the children reach six years of age. In order to investigate this effect of nutrition more thoroughly and to determine whether or not nutritional condition had a significant effect on the growth of these children, a paired comparison was made of the mean weights and the mean heights of the children in the two nutritional groups (Figures 36 and 37). Insofar as weight was concerned

(Figure 36), it is clearly evident that the well-nourished children are heavier than the poorly nourished children. The difference is greatest in the younger age groups and tends to be less as the children become older. This tendency can be described by a regression line which was fitted to the observations by the Method of Least Squares. The slope of this regression was 0.912. Using the standard deviation of the regression (S_{yx}) as an estimate of the error team, it could be shown that at age two the well-nourished children were significantly heavier than the poorly nourished children ($t = 7.3$; $P < 0.001$). The same general trend holds for height (Figure 37). Poorly nourished children were shorter than well-nourished children and the difference tended to decrease as the children became older. At about age two the difference was highly significant ($t = 8.0$; $P < 0.001$).

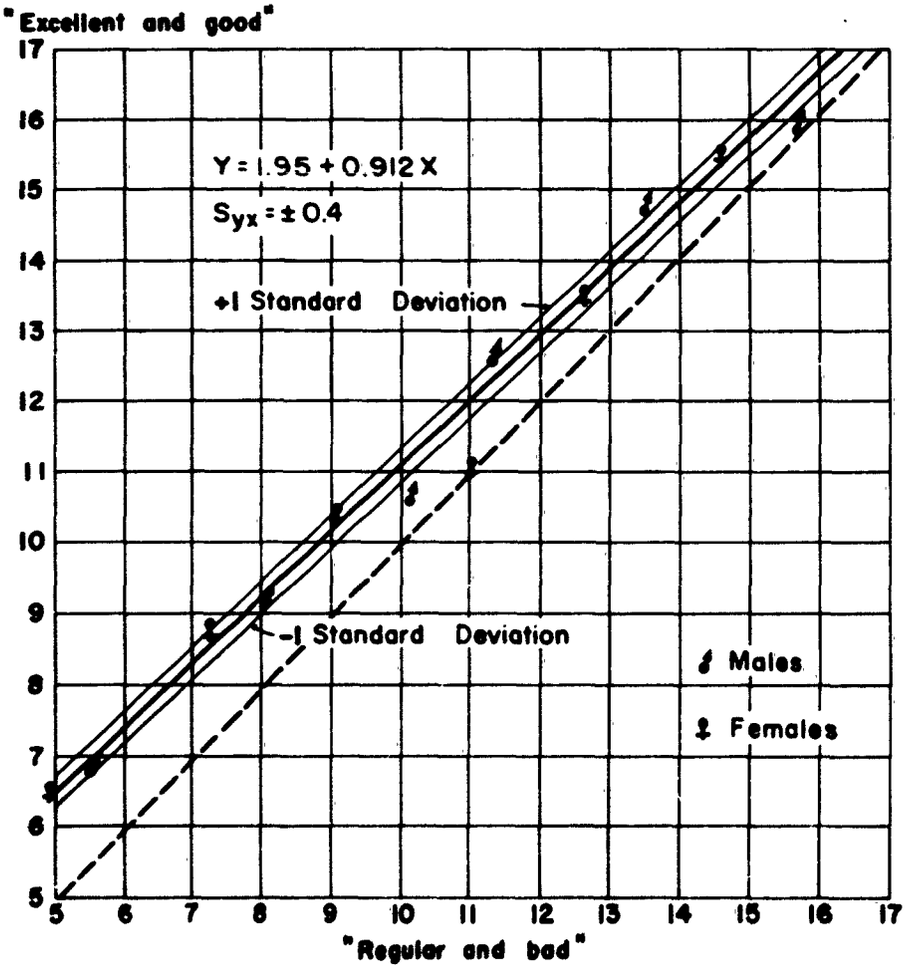
It is not surprising to find that nutrition has an effect on growth, this is a well-known fact. The tendency for this effect to become less evident as the child grows older has been observed by others in Guatemala. INCAP researchers have observed that well-nourished Ladino children follow the same bone maturation course as do American children. Guatemalan children in low income and rural families are marked by a lag in maturation until four years of age. These children, when they reach school age, are usually more than two years behind well-nourished children in skeletal maturity.[121]

Comment. These various nutritional findings raise two important questions. First, do 12 cases of kwashiorkor among 1,193 children represent a high or

[121] Munoz and Guzman, op. cit., p. 60.

Figure 36

Influence of nutrition on growth on 1,200 Guatamalan pre-school children



a low rate for this disease? Second, are the differences in the intensity of malnutrition between the two groups of villages sufficient in themselves to account for the differences in total mortality?

The literature on protein malnutrition and kwashiorkor for Latin America was carefully scrutinized for quantitative information on the morbidity and mortality rates for these diseases. No publication was found in which a rate was given. Some authors[122] reported that they had seen a certain number of cases of these diseases in one or another type of survey, but no statement was made regarding the total number of cases examined or the total cases admitted to a hospital; therefore a morbidity rate could not be derived. Other authors[123] merely recorded that kwashiorkor was "common," "uncommon," "frequent," or "not observed." Even when reports from regions other than Latin America were examined quantitative data were lacking and the phraseology was comparable with that just mentioned.[124] Thus, it is impossible to decide whether 12 cases of kwashiorkor among 1,193 children is, in fact, a very high incidence or not. Certainly any cases of this disease represent a serious nutritional problem, for the disease is characteristically either fatal or very debilitating to the survivors.

These considerations concerning the magnitude of severe malnutrition are much more than academic ones, for the central problem is to explain

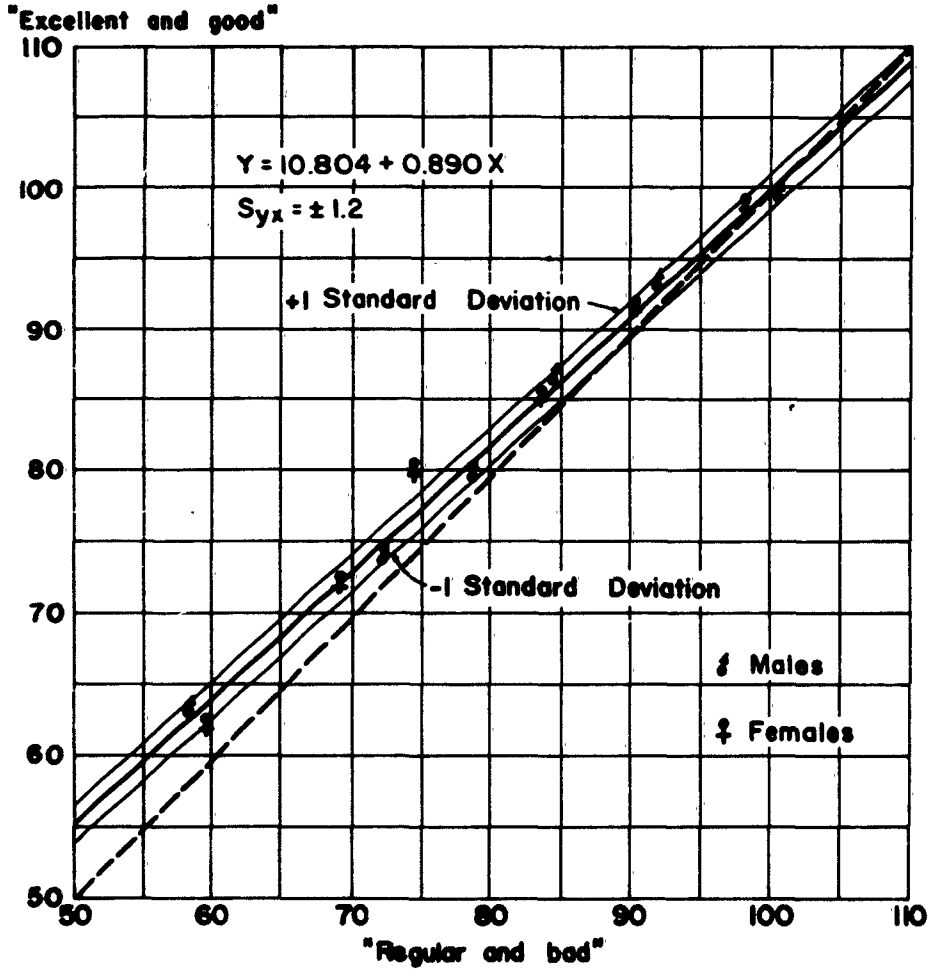
[122] Autret and Behar, op. cit., p. 5.

[123] Trowell, op. cit., p. 20.

[124] Autret and Behar, op. cit., p. 7.

Figure 37

Influence of nutrition on growth on 1,200 Guatamalan pre-school children



the large differences in mortality between the two groups of villages. While it is true that there are three times as many cases of kwashiorkor and starvation in Group A as in Group B, in point of fact there are in all, only 12 cases of kwashiorkor and four of starvation (Table 13). Since this number of cases is too small to judge the relative importance of malnutrition as a cause of the differences in mortality, we must consider the other nutritional evidence collected. Two observations suggest that factors other than malnutrition are probably more important. First, although there is a greater frequency of specific signs of malnutrition among the children of Group A than those of Group B, the difference is not highly significant (Table 12). Second, and more weighty, is the fact that between 80 and 90 per cent of all the children examined can be classified in good and regular nutritional groups (Table 14). Only in the cases of the excellent and bad classes are there statistically significant differences between the two groups of villages. These facts indicate that rather than being the cause for the differences in mortality between Group A and Group B, malnutrition more probably predisposes the children to the action of other environmental factors. The next stage in the analysis of the observations made in Guatemala is thus a critical examination of these other environmental factors.

CHPATER VII

ANALYSIS OF THE ENVIRONMENTAL FACTORS AS THEY AFFECT THE MORTALITY OF THE PRE-SCHOOL CHILD

The analysis of the information of the nutritional status discloses five points. First, that the incidence of kwashiorkor is small. Second, the nutritional condition does not influence height or weight significantly, but the data do suggest that regular and bad nutritional groups grow more slowly than excellent and good nutritional groups. Third, Guatemalan children are lighter and shorter than American children regardless of nutritional condition. Fourth, there is a difference in the incidence and intensity of malnutrition between Group A and B villages and towns, but it is confined to the extremes. Fifth, the incidence and intensity of malnutrition does not seem sufficient to account for the great difference in mortality between Groups A and B.

The contrast that does exist between the incidence and intensity of malnutrition in the nine villages and the variation in mortality between Groups A and B may be due to the effect of the environmental factors, either acting singly or in combination.

Three analyses were made. In the first analysis, the questions asked were (1) does the location of the village have any relation to its mortality rate? (2) is the basic economy related to the mortality? Seven villages were located in the Central Highlands, of these, four had a low and three had a high mortality. Two villages were located in the Coastal Lowlands; in both the mortality was high. Of the highland villages which had a high mortality, two had a subsistence and one a commercial economy. Of the

highland villages with a low mortality, one had a subsistence and three had a commercial economy. Both villages in the Coastal Lowlands had a commercial economy. These facts suggested that something more fundamental than mere location or broad designation of economy was involved in the large difference in mortality.

To accomplish a more detailed examination of the environmental elements, 43 were selected for study. A table was prepared in which the presence or absence of these factors, classified according to the categories of agriculture, economy, and public health, was noted by a "+" or "-" symbol and the table was scrutinized to see if there were any correlations between these signs and mortality (Table 17). This method was not sufficiently discriminatory to permit an accounting for the mortality. Therefore, each town and village was ranked, in the case of each of these 43 items, from one to nine. One means "least bad" or "most good" and nine means "worst" or "least good." Two criteria were used in judging the rank order of each of the villages. First, official data from governmental agencies were used as a quantitative basis for ranking. Second, when such information was not available, the author then drew upon his field notes in order to assign a rank. The latter, it must be pointed out, were subjective judgments.

The next step was to add up the number of times the numerical rankings of each village and town fell into the three triads: good (one to three), average (four to six), bad (seven to nine). These summations have been given in Table 18, where the villages have been listed according to whether they belong to Group A or to Group B. Since there were an unequal number

of villages in the two groups, the mean frequency was calculated for the three triads, in the case of both groups. In Group A, there are almost three times as many factors in the third triad as in the first triad. In Group B, all the villages, except San Vicente Pacaya, have almost twice as many factors in the first triad as in the third triad. Group B villages have more than twice the number of elements in the first triad than towns of Group A. In Group A, the villages have more than twice the number of elements in the third triad than do the villages of Group B. Thus, although the frequency of rankings was approximately equal in the middle triad, the villages in Group A tended to rank in exactly the reverse order of Group B. Furthermore, a high mortality rate was correlated with a high frequency of elements ranked in the third triad and a low mortality rate was correlated with a high frequency of elements ranked in the first triad.

The problem that remains is to explain why the factors which rank in the third triad were detrimental to the health of the inhabitants of these villages and why the factors that rank in the first triad were beneficial to their health. Within the agricultural category (Table 17), the most discriminatory factor was "frequent flooding or drought," which was experienced by three of the five Group A villages, but by none of Group B. Essential food and cash crops would be washed away by flooding streams and much needed second harvests eliminated by droughts. Soil infertility and soil erosion and gullying were present in all nine villages, but these conditions were much worse in Group A villages than in Group B. The quality and quantity of both subsistence and commercial crops were lower in Group A

TABLE 17

THE PRESENCE OR ABSENCE OF 43 ENVIRONMENTAL FACTORS, THEIR RANKING AMONG THE NINE VILLAGES AND TOWNS INVESTIGATED[a]

Environmental Factors	Group A				Agroup B				
	San Jose	La Democracia	Concepcion	San Antonio La Paz	San Antonio Palopo	Aquacatan	San Pedro Carcha	Chichicastenango	San Vicente Pacaya
Agricultural									
1. Soil Erosion and Gullying	+1	+4	+7	+9	+8	+3	+4	+5	+6
2. Planting on Steep Slope	-1	-2	+7	+7	+9	+4	+3	+5	+6
3. More than One Crop Planted	+2	+1	-5	-5	-5	-5	-5	-5	-5
4. Soil Infertility	+4	+4	+7	+9	+8	+3	+4	+5	+5
5. Plows and Oxen Used	+4	+2	-5	-5	-5	+1	-5	-5	-5
6. Cash Crops Raised	+4	+8	+7	+2	+5	+9	+6	+4	-9
7. Fertilizer Used	-5	-3	-6	-8	+1	+1	-3	-7	-5
8. Livestock Raised	+5	+4	+1	-6	-9	+1	-3	-7	-9
9. Irrigation Practiced	-5	-5	-5	-5	+1	+1	-5	-5	-5
10. Subsistence Crops Terraced	-6	-6	-6	-6	-6	+1	-6	-6	-6
11. Cash Crops Terraced	-6	-6	-6	-6	+1	+1	-6	-6	-6
12. Farm Sizes Adequate	-8	-4	-7	-7	-6	-2	-1	-5	-9
13. Adequate Food Crops Raised	-8	-4	-4	-7	-6	-2	-1	-5	-9
14. Frequent Flooding or Drought	+9	+9	-1	+9	-1	-1	-1	-1	-1
Economic									
15. Manufacturing Present	+1	-9	-9	-4	-9	+1	-4	+1	-9
16. Service Industries Present	+1	+6	+2	+8	-9	+4	+3	+7	+2
17. Market Facilities Available	+2	-8	-8	-8	-8	+4	+3	+1	-9
18. Transportation to Markets	+3	+2	+6	+4	-9	+7	+8	+3	+1

Table 17 (Continued)

Environmental Factors	San Jose	La Democracia	Concepcion	San Antonio La Paz	San Antonio Palopo	Aquacatan	San Pedro Carcha	Chichicastenango	San Vicente Pacaya
Public Health									
19. Drinking Water Available	+1	+1	+1	-9	+1	+1	+1	+1	+5
20. Medicine Sold in Local Stores	+1	+4	-9	-9					
21. Food Establishments Present	+1	+2	-9	+6	-9	+5	+3	+3	-6
22. Food Items Sold in Local Stores	+2	+6	+5	+8	+9	+3	+3	+1	+5
23. Medical Facilities Present	+3	+4	-7	-8	-9	-5	-6	+1	+2
24. Dirt Floors	+4	+7	+7	+5	+7	+3	+2	+3	+6
25. Electricity in Houses	-4	-7	-7	-7	-7	-7	-7	-7	-7
26. Running Water in Dwellings	-4	-7	-9	-9	-9	-9	-1	-2	-7
27. Excreta Observed in Town	+4	+5	+4	+6	+5	+9	+1	+2	+5
28. Zoonoses Present	+4	+4	+4	+4	+4	+4	+4	+4	+4
29. Shoes Worn	+4	+3	+5	+6	-8	+1	+2	-8	+2
30. More than 50% Illiteracy	+5	+5	+5	+5	+5	+5	+5	+5	+5
31. Shortage of Sleeping Space	+7	+9	+2	+3	+5	+3	+6	-1	-5
32. Washing Facilities	+7	+6	+2	-9	+1	+5	+3	+3	-6
33. Adequate Toilet Facilities	-9	-8	-3	-2	-5	-7	-1	-6	-3
34. Garbage Disposal	-9	-8	-7	-6	-7	-2	-1	-3	-3
35. Rodents, Insects	+9	+8	+5	+2	+6	+4	+1	+7	+3
36. Public Sanitary Facilities	-9	-9	-9	-9	-9	-9	-9	-9	-9
37. Adequate Cooking Facilities	-9	-9	-9	-9	-9	-9	-9	-9	-9
38. Shortage of Houses	+9	+9	+2	+3	+5	+3	+6	-1	+5
39. Adequate Ventilation	-9	-9	-9	-9	-9	-9	-9	-9	-9
40. Stagnant Pools, Swamps	+9	+8	-1	-1	-1	-1	-1	-1	-1

Table 17 (Continued)

Environmental Factors	San Jose	La Democracia	Concepcion	San Antonio La Paz	San Antonio Palopo	Aquacatan	San Pedro Carcha	Chichicastenango	San Vicente Pacaya
41. Animals in Houses	+9	+9	+9	+9	+9	+9	+9	+9	+9
42. UNICEF Milk Program	-9	-9	-9	+2	-9	+1	-9	-9	-9
43. Drunkenness Observed	+9	+8	+4	+4	+4	+4	+4	+4	+4

[a]+ or - signs indicate presence or absence of a factor; numbers indicate subject rank.

TABLE 18

NUMBER OF TIMES 43 ENVIRONMENTAL FACTORS WERE RANKED IN THREE TRIADS FOR EACH VILLAGE

Group and Village	Good (1-3)	Average (4-6)	Bad (7-9)
Group A			
San Jose	12	15	16
La Democracia	8	16	19
Concepcion	9	15	35
San Antonio La Paz	7	14	22
San Antonio Palopo	7	14	22
Total	43	74	114
Average	8	14	22
Group B			
Aquacatan	22	11	10
San Pedro Carcha	21	15	7
Chichcastenango	18	14	11
San Vicente Pacaya	9	21	13
Total	70	61	41
Average	17	15	10

villages than in villages of Group B. Although not so obvious, such elements as planting crops on a steep slope and inadequate farm sizes were characteristic of more Group A villages than Group B and might have been responsible for low yields, soil infertility, and the necessity of seeking other employment in order to obtain food.

The most meaningful environmental factor in the economic classification (Table 17) is "market facilities available." Four of the five villages of Group A do not have markets and the villagers must travel to another village market if they have something to sell or wish to purchase food items. With the exception of San Jose, the remaining Group A villages are without manufacturing and the economy is based on agriculture.

The greatest number of discriminatory environmental factors are observed under the public health division (Table 17). The lack of medical facilities and the inability to obtain medicines from local stores may have caused the mortality rate to be higher in Group A villages than in Group B. In Group A villages there are few food establishments and little food is sold in local stores. Washing facilities and garbage disposal are inadequate in Group A towns. Furthermore, these communities are more unsanitary than Group B villages. Another discriminatory and critical factor in Group A is the housing problem. A greater number of the dwellings with dirt floors are in poor condition in Group A than in Group B. In addition, there is a severe shortage of houses, sleeping rooms, and beds. The villages of Group A, located in the coastal lowlands, have numerous adjacent stagnant pools and swamps and consequently have more insects, pests, and rodents than do villages of Group B. Drunkenness is more

common in Group A villages and thus indirectly deprives families of much needed food supplies.

The only and important exception, as seen in Table 17, is San Vicente Pacaya. Although it is a village in Group B, it has more environmental factors ranked in the third triad than in the first. The explanation for this exceptional ranking may be the fact that there is an active and vigorous Rural Health Service Center. Having won the confidence of the villagers, the doctor and nurses have undertaken the task of attempting to raise the standard of living of the inhabitants. In addition to medical services, the townspeople are shown proper sanitary methods and instructed in food preparation and storage, sewing, and home improvement. The success of this program is clearly evident in the low mortality rate, even though the village has many adverse environmental factors to contend with.

This analysis showed that public health, agricultural, and economic factors were probably quite important in explaining the ranking of the two groups of villages. The fact that conditions related to public health were particularly significant in the ranking of the villages suggests that the presence of communicable diseases may have been responsible for the greater mortality among the villages of Group A. Even though the majority of certificates of death are prepared by laymen, such as mayors and sub-officials, and the vital statistics of the Public Health Department reflect this fact, for what they are worth, those data indicate that the majority of deaths among pre-school children are due to "dysentery" and "parasitism."

One exception to the ranking of the villages supports this evidence concerning the importance of community hygiene. That is San Vicente Pacaya,

a village of Group B. This town had a far greater number of items in the third triad than in the first (Table 18). In fact, the profile was identical with that of the Group A villages. In spite of this poor ranking, the mortality was only 30 per cent. In that village a superior public health program, education of the inhabitants, personal hygiene, and home improvement, may well have been responsible for the differences that do exist in the mortality rate between the villages and towns of Group A and Group B.

CHAPTER VIII

RECOMMENDATIONS

Since there is overwhelming evidence that the production of foodstuffs fails to meet the minimum nutritional requirements, more food must be produced: not only corn and beans, but all types that contain vegetable and animal protein of high biological value. The majority of this increased food production should come mainly from the small farms. At present governmental assistance, such as the agricultural extension service, has been directed towards the farmers supplying the urban markets. Money has acted as an incentive for the majority of these farmers and they have usually reacted favorably to technical advice which would enable them to increase their income. There is no denying that the development of this type of agriculture and the improvement of the food supply of the urban population is important, but still one must not forget that the overwhelming majority of the Guatemalan population is rural. The critical problem is to instruct the agricultural population how to produce more and better products.

Increasing the efficiency of the small farmer is basic to the problem. One possible method is the introduction of irrigation. Although irrigation would not require extensive mechanical ability on the part of the farmer and probably would not increase the presently cultivated areas, it would enable the farmers to produce an additional crop on their present holdings during the dry season. Another serious problem is that of soil infertility. At present, little is known about the reaction of the soil to various fertilizers. Until methods are devised to replenish the soil faster than it is presently

being replaced by floods and other natural causes, it might be wiser on the part of the government to move slowly in the introduction of improved corn types, which would draw fertility from the soil faster than the native varieties now do.

Consideration should be given to the delimiting of crops to areas most suited for them, substituting intensified agricultural methods in the over-populated Central Highlands, and a greater integration of present plant production with a more realistic animal husbandry program. The development of more practical soil management methods, such as soil conservation, contour farming, terracing, and weed control, should be instigated if increased yields are to be realized.

At present, it is impossible to conceive that Guatemala could possibly support an animal economy sufficient to provide animal protein for all of her population. Traditional agricultural methods, inadequate incomes, and a lack of knowledge prohibits, the possibility of such a program. The alternative lies in the improvement, development, and utilization of the existing vegetable protein sources. It is known that proteins obtained from seed sources are deficient in their amino acid content and consequently, have a low biological value. In spite of these deficiencies and imbalances, it has been shown by INCAP that it is possible to combine certain seeds or their products in ways which would furnish an adequate amino acid balance, thus providing proteins of a better biological value. The present crop varieties are the result of selection under given systems of production. The basic food crops are the products of selection by a subsistence agriculture and

represent a combination of factors which contribute to a high degree of constancy of production under widely varying environmental conditions.

Supplementary feeding and a more efficient distribution and utilization of available animal protein would greatly improve the Guatemalan diet. Since 1950, the United Nations Children Emergency Fund (UNICEF) has provided skim milk products, which have been used primarily for children of school age. Unfortunately, the remoteness and lack of funds to pay the internal transportation charges have made it impossible for many settlements to obtain this desirable supplement. The government should undertake the responsibility of delivering the milk powder to all villages throughout the country. An effort should also be made to expand the supplementary feeding to pre-school children and expectant and nursing mothers.

Fishing restrictions need to be re-evaluated. Commercial fishing is virtually nonexistent and what little fish is caught is eaten mainly in the coastal areas. Dietary surveys of Central Highlands population groups have shown that their consumption of fish is practically nil. The government should encourage not only the development of the fishing industry, but also the refrigeration and transport facilities essential to such an industry. If, because of price, fresh, frozen, or preserved fish would remain beyond the reach of the majority of the population, then attention should be devoted to the production, processing, and acceptance of dried, salted, or smoked fish. To offset remoteness and inaccessibility, fish-pond culture could be introduced to the rural population, providing them with a cheap, protein-rich source of food.

Intimately involved in the agricultural development are several socio-economic problems. The most critical to the entire problem are educational and cultural barriers. These are especially important in the areas of subsistence agriculture, where illiteracy reaches almost 90 per cent and the percentage of the school age population receiving an education is very low, less than 20 per cent. If a farmer is to be able to apply fertilizer or insecticides intelligently, for example, he needs to understand why such things are necessary. If he is to be able to manage to produce products of higher quality, he should be able to read, write, and figure. It should be noted that merely educating a small group of the farm population is not sufficient to convert the present agricultural system into a more efficient one in terms of increased production per person. The average production per man is low and the wages he receives are inadequate. It was pointed out that the amount of mechanization is slight, mainly because uneducated laborers and the labor performed by hand methods are cheaper than machinery. The government should realize the severity of the problem and face the fact that the problem of education is a national one.

The expansion of the present public health program is vital if the standard of living is to be improved. The Division of Rural Services of the Department of Public Health and Social Welfare has performed unbelievable services in spite of tremendous obstacles, but unfortunately, only a small percentage of the population has benefitted.

Sanitation in Guatemala, with respect to water purification, water supply, drainage and sewage, garbage disposal, removal of excreta,

insects and rodents, food storage, and dwellings, is almost completely lacking. These problems, critical to the well-being of the population, could be controlled and possibly, eliminated, through the efforts of the Rural Health Centers. An educational program, organized on the basis of an area's own needs, would not only help solve its problems, but would also transmit knowledge and achieve practices which would mean benefits for the entire population.

The success of expanding the Rural Health Center Program depends upon the various communities and community effort. If the inhabitants do not fully understand the objectives of such a program, they will not take much interest in the work, except for possible emergencies. Such was the case in several of the dispensaries which were located in the villages and towns that the research team visited. The citizens should be informed of the various goals and these can only be achieved with the full and active participation and cooperation of all individuals.

Are changes and improvements possible? Improvement has not and will not come easily for Guatemala. Although the Indian is illiterate and superstitious, it is wrong to conclude that he will not accept innovations. The history of Indian culture reveals that they have deviated from tradition, but only when they perceived the alteration to be useful. When plans for deviations were imposed upon them, the Indian resisted. However, when proposed changes, in the form of alternatives, were offered to them, to be freely accepted or rejected, the Indian cooperated.

As was observed in even the most remote village investigated, the spirit of enterprise was widespread among both Ladinos and Indians. The

Indian is desirous to supplement his meager resources, but it must be in his own ways. Attempts by the government to impose specific changes have failed, because the Indian was not given the opportunity to choose freely or helped to understand what will result from his alteration of the traditional ways of living.

What the Indian will and will not do becomes the key to either success or failure. Once the government officials come to understand the Indian and the necessity of permitting him to elect freely to change to the direction that he considers to be most beneficial, then and only then will they be able to initiate a program that would help to eliminate malnutrition and improve public health.

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APPENDIX A

SAMPLE QUESTIONNAIRE USED FOR GEOGRAPHICAL AND SOCIO-ECONOMIC SURVEY OF SELECTED TOWNS AND VILLAGES

1. Place_____

2. Municipality_____ Department_____

3. Distance from Capital_____ (Km.)

4. Population

   Total_____

   Males_____

   Females_____

   Ladinos_____

   Indians_____

5. Number of Families_____

   Average Number of Persons Per Family_____

6. Distribution by Ages

   0-6 Years_____

   7-10 Years_____

   11-20 Years_____

   21-40 Years_____

   41-60 Years_____

   61- Years_____

7. Number of Laborers, 7 years and Older

   Male_____

   Female_____

8. Topography (Slope, Erosion, Etc.)

9. Soil Type and Fertility

10. Rivers and Lakes

11. Climate

Dry Season_____

Wet Season_____

Amount of Rainfall_____

12. Natural Vegetation

13. Agriculture

Number of Farms_____

Average Farm Size_____

Total Cultivated Area_____

Acreage in Crops_____

Acreage in Fallow_____

Acreage in Pasture_____

Acreage in Forests_____

14. Farm Ownership

Private_____

Tenant _____

Cost/Acre_____

Squatter_____

15. Farm Equipment

Wood Plows_____

Metal Plows_____

Other Types_____

16. Agricultural Practices

Irrigation_____

Fertilization_____

Terracing_____

Rotation_____

Others_____

17. Agricultural Products

Cereals

Corn_____ Acres

First Crop_____ Acres

Second Crop_____ Acres

Wheat_____ Acres

Oats_____ Acres

Rice_____ Acres

Others_____ Acres

Legumes

Kidney Bean_____ Acres

Lima Bean_____ Acres

String Bean_____ Acres

Peanuts_____ Acres

Others_____

Tuber and Root Crops

Potato_____ Acres

Sweetpotato_____ Acres

Yuca (Manioc)_____ Acres

Vegetables

Tomatoes _____ Acres

Onions _____ Acres

Chiles _____ Acres

Garlic _____ Acres

Cucurbits _____ Acres

Beets _____ Acres

Radish _____ Acres

Peppers _____ Acres

Cabbage _____ Acres

Lettuce _____ Acres

Cauliflower _____ Acres

Others _____

_____

_____

Fruits

Oranges _____ Trees

Apples _____ Trees

Peaches _____ Trees

Plums _____ Trees

Lemons _____ Trees

Limes _____ Trees

Coconuts _____ Trees

Avocados _____ Trees

Bananas _____ Trees

Plantains _____ Trees

Melons _____ Trees

Others _____

_____

_____

Sugar

Panela _____ Acres

Other _____ Acres

Cotton _____ Acres

Coffee _____ Trees

Cacoa _____ Trees

18. Livestock

Cattle _____

Milch Cows _____

Pigs _____

Sheep _____

Goats _____

Oxen _____

Mules _____

Horses _____

Burros _____

Poultry

Chickens _____

Hens _____

Ducks _____

Turkeys_____

Geese_____

Others_____

_____

19. Livestock Products

Type and Amount

Slaughtered_____

Milk_____ Liters

Eggs_____ Dozens

Butter_____ Lbs.

Cheese_____ Lbs.

Wool_____ Lbs.

20. Fish

Types Caught_____

Amount_____ Lbs.

21. Industry

Type_____

Number_____

Number of Employees_____

Wages Paid_____

22. Transportation and Communications

Roads_____ Miles

Paved_____ Miles

Motor Vehicles_____

Autos_____

Trucks_____

Buses_____

Train_____Miles

Telephone_____

Telegraph_____

Postal Service_____

23. Forest Products

Lumber_____ Feet

Firewood_____ Feet

Pulp_____ Lbs.

Resins_____ Liters

Chicle_____ Lbs.

Rubber_____ Lbs.

24. Mining Activities

Type_____

Number of Mines_____

Number of Employees_____

Wages Paid_____

Location_____

25 Health

Hospital_____

Clinic_____

Doctors_____

Dentists_____

Nurses_____

Drugs Available_____

Midwife_____

26. Education

Illiterates_____

Schools_____

Students_____

Teachers_____

Rooms_____

27. Houses

Total Number_____

Rooms (Average/House)_____

Owned_____

Rented_____

Toilet Facilities

Inside_____

Outside_____

None_____

Electricity_____

Dirt Floor_____

Other_____

Roof Type_____

Wall Type_____

Number of Doors_____

Number of Windows_____

Ventilation_____

28. Market

Time and Day Held_____

Products Sold_____

_____

_____

29. Services Performed by Town

Administrative_____

Religious_____

Commercial

Type of Stores

General_____

Grocery_____

Pharmacy_____

Butcher_____

Clothing_____

Barber_____

Funeral_____

Bars_____

Others_____

30. Basic Economy of Town

Subsistence Agriculture_____

Commercial Agriculture_____

Manufacturing_____

Services_____

Mining_____

APPENDIX B

REGIONAL SIGNS OF MALNUTRITION GROUPED ACCORDING TO FREQUENCY AND SEVERITY: TOTAL CASES

(Degrees of severity: 1 = doubtful, 2 = slight, 3 = moderate, 4 = severe)

Region and Sign Numbers	Group A				Group B			
	1	2	3	4	1	2	3	4
Hair (1-2)	28	51	3	2	8	34	2	1
Eyelid (3-5)	20	141	16	5	11	145	17	6
Palpebral Conjunctiva (6-7)	41	142	8	0	13	240	20	0
Bulbar Conjunctiva (8-14)	133	553	55	3	61	760	84	6
Cornea (15-17)	46	183	7	0	25	193	11	0
Face (18-23)	43	196	3	0	14	274	7	0
Lips (24-26)	64	131	9	3	8	53	2	3
Gums (27-30)	31	201	16	2	9	176	17	0
Tongue (31-39)	107	287	28	1	22	228	5	3
Teeth (41-45)	40	445	138	62	20	514	151	66
Mucous Membranes (46)	26	101	11	5	8	78	5	0
Neck (47	7	37	2	0	2	4	0	0
Skin (49-57)	30	90	14	5	39	275	24	3
Abdomen (58)	16	112	8	0	3	115	9	0
Nails (59-60)	20	54	5	0	6	77	3	3
Skeleton (61-62)	1	0	1	1	0	0	0	2
Nervous System (63-64)	3	9	5	4	3	12	4	7
Subcutaneous Tissue (65)	6	8	5	1	1	7	1	3

APPENDIX C

VARIOUS DISEASES OBSERVED IN GROUPS A AND B

(M = Male; F = Female)

Condition	Group A					Group B				
	Total	Indian		Ladino		Total	Indian		Ladino	
		M	F	M	F		M	F	M	F
Caries	216	12	19	97	88	231	21	31	92	87
Goiter	56	4	7	22	23	151	16	18	65	52
Kwashiorkor	9	0	1	3	5	3	1	0	0	2
Starvation	3	0	1	0	2	1	1	0	0	0
Other Pathology										
Hepatomegaly	15	1	0	7	7	3	0	0	2	1
Splenomegaly	1	0	0	0	1	1	0	0	1	0
Diarrhea	0	0	0	0	0	3	2	0	0	1
Heat Rash	5	0	0	3	2	0	0	0	0	0
Conjunctivitis	7	3	3	0	1	5	1	2	1	1
Adenopathy	0	0	0	0	0	2	1	1	0	0
Ascariasis	0	0	0	0	0	2	0	0	1	1
Scabies	0	0	0	0	0	1	0	1	0	0
Eye Infection	1	0	1	0	0	2	0	2	0	0
Dermatosis of Ear	6	5	1	0	0	2	0	1	0	1
Hernia	0	0	0	0	0	4	1	0	2	1

APPENDIX D

SKINFOLD THICKNESS

Class Interval (mm)	Group A Excellent and Good (No.)	Group A Regular and Bad (No.)	Group B Excellent and Good (No.)	Group B Regular and Bad (No.)	A and B Pooled Excellent and Good (%)	A and B Pooled Regular and Bad (%)
2.0-2 9	0	0	1	-	0.17	0.00
3.0-3.9	0	1	0	4	0.00	1.92
4.0-4.9	2	6	2	7	0.67	4.98
5.0-5.9	5	7	12	21	2.84	10.72
6.0-6.9	13	17	37	28	8.35	17.24
7 0-7.9	25	11	51	26	12.69	14.17
8.0-8.9	25	15	59	18	14.03	12.64
9.0-9.9	32	6	70	34	17.03	15.32
10.0-10.9	31	10	79	14	18.37	9.19
11.0-11 9	10	4	65	13	12.52	6.51
12.0-12 9	9	2	31	8	6.68	3.83
13 0-13.9	6	3	13	2	3.17	1.92
14.0-14.9	2	0	9	1	1.84	0.38
15 0-15 9	0	0	3	1	0.50	0.38
16.0-16.9	2	1	3	0	0.84	0.38
17.0-17.9	1	0	0	0	0.17	0.00
18.0-18 9	1	1	0	0	0.17	0.38

APPENDIX E

HEIGHTS AND WEIGHTS OF NUTRITIONAL GROUPS, BY SEX

(Mean and standard deviation)

Males Age (Yr.)	Excellent and Good			Regular and Bad		
	No.	Weight (kg)	Height (cm)	No.	Weight (kg)	Height (cm)
0-1	73	6.8± 1.4	63.2± 6.1	8	5.5± 1.7	58.0± 5.3
1-2	59	9.1± 1.2	73.6± 4.0	35	8.1± 3.0	72.2± 3.6
2-3	64	10.6± 1.4	79.5± 5.7	41	10.1± 1.6	79.1± 5.4
3-4	74	12.6± 1.4	86.5± 6.7	23	11.3± 2.2	84.1± 6.0
4-5	63	14.7± 1.5	92.8± 9.8	30	13.5± 2.0	92.1± 6.6
5-6	65	15.9± 2.0	98.7± 7.1	44	15.7± 1.7	100.5± 7.8
Females						
0-1	77	6.1± 1.4	62.6± 5.7	10	4.9± 1.1	59.8± 8.1
1-2	72	8.9± 1.4	72.3 ± 4.7	32	7.2 ±1.1	68.9± 4.0
2-3	56	10.5± 1.4	80.1 ± 5.5	47	9.1± 1.9	75.3 ±5.9
3-4	65	11.2± 1.8	85.8± 6.6	34	11.0± 2.0	83.2 ± 5.3
4-5	63	13.6± 1.4	91.9 ± 6.2	31	12.6± 2.3	90.2± 7.3
5-6	73	15.6± 2.0	98.0± 7.4	51	14.6± 2.1	97.8± 8.3

VITA

Herbert L. Slutsky was born on November 6, 1925, in Chicago, Illinois. After graduating from Hyde Park High School, Chicago, Illinois, in 1942, he enlisted in the United States Navy and served in the Medical Department at both stateside and overseas stations. In 1946, he entered the University of Illinois, where in 1950 he obtained a Bachelor of Science degree in Geography. He received the Master of Science degree in Geography from this institution in August, 1951. In September, 1951, he was recalled to active duty and served with the United States Navy Medical Department in Korea and Japan. In the fall of 1953, he resumed graduate work in geography at Illinois and at various times during his graduate studies, he was a research associate and teaching assistant at the University. In 1957, he received a National Academy of Science - National Research Council Fellowship to carry out a medical geographical research study in Guatemala, Central America. During the summer session, 1958, he was a Visiting Lecturer in Geography at the Navy Pier Branch, University of Illinois, Chicago, Illinois. He is a member of Society of Sigma Xi.

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