

The Ongoing Evolution Of Latin American Populations

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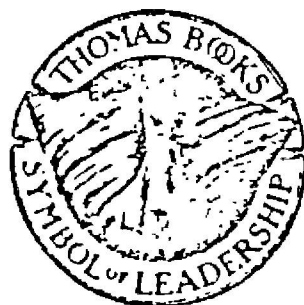
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Chapter 11

NUTRITIONAL STUDIES IN CENTRAL AMERICA AND PANAMA

MARINA FLORES

INTRODUCTION

The nutritional problems of the populations of Central America and Panama were first brought to light when the Institute of Nutrition of Central America and Panama (INCAP) began its formal work in 1950.

As in any other developing area, the high mortality rate in children (Scrimshaw, 1958) constituted the first indication of the existence of nutritional deficiencies. It was found that the most acute problem among underprivileged groups is the prevalence of protein malnutrition (Scrimshaw *et al.*, 1958). Retardation of growth and development in children, as a consequence of poor weaning practices and inadequate substitutes for the mother's milk, is one of the most serious results. As in the rest of the world, protein malnutrition appears when the child is fed with cereal flours instead of milk or other high protein foods of good quality to meet the requirements of the child. In this condition, any additional stress that the child may suffer, such as an infection, precipitates its death.

Other serious conditions revealed by certain field studies included the deficiency of vitamin A (Oomen *et al.*, 1964), damaging eyesight and lowering resistance to infection in all ages; the prevalence of endemic goiter (Scrimshaw, 1957), in which lack of iodine and the presence of some goitrogenic factors affect some groups living in the highlands; and deficiency in iron, vitamin B₁₂, folic acid and high quality protein, producing anemias responsible for high mortality rates among pregnant and lactating women, especially in the lowlands (Vilter, 1956).

INCAP undertook a fourfold program in its analysis of the nutritional problems of these populations. It first endeavored to evaluate as intensively as possible nutritional status and to determine the main factors affecting health and performance. Second, through an extensive analysis of the consequences of these nutritional deficiencies, INCAP looked for practical and effective solutions to the existing health and performance problems. To help implement these solutions, INCAP presented its recommendations for action to national governments, and in order to facilitate the establishment of these programs undertook the training of professional and technical personnel.

Although the nutritional problems were all recognized when INCAP first came into existence, their extension and magnitude were not known until recent years, when a national nutritional survey was conducted in each of the six Central American countries. The survey included all aspects of the people's nutritional status, and some results will be presented here as a descriptive picture of the present situation in Central America and Panama.

PEOPLE AND ENVIRONMENT

The territory of Central America encompasses the area between Mexico and Colombia, approximately 8° to 18° Northern latitude and 78° to 90° longitude and includes Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama as Figure 11.1 shows. Although all of the countries of Central America are in the tropical zone, the temperature and rainfall patterns vary greatly with altitude. The chain of mountains crossing from North to South, parallel to the Pacific Coast, containing about 250 volcanoes, vary in elevation from 6,000 to 13,000 feet above sea level. The mean annual temperature in this small area ranges from 30 to 35°C. in the lowlands to 10 to 15°C. in the highlands. The yearly seasons, characterized as wet and dry, are called summer and winter irrespective of temperature; the second falls between May and October, with heavy rainfalls which make fertile soils appropriate for cultivation in the whole region.

The economy of these countries depends mainly on agricul-

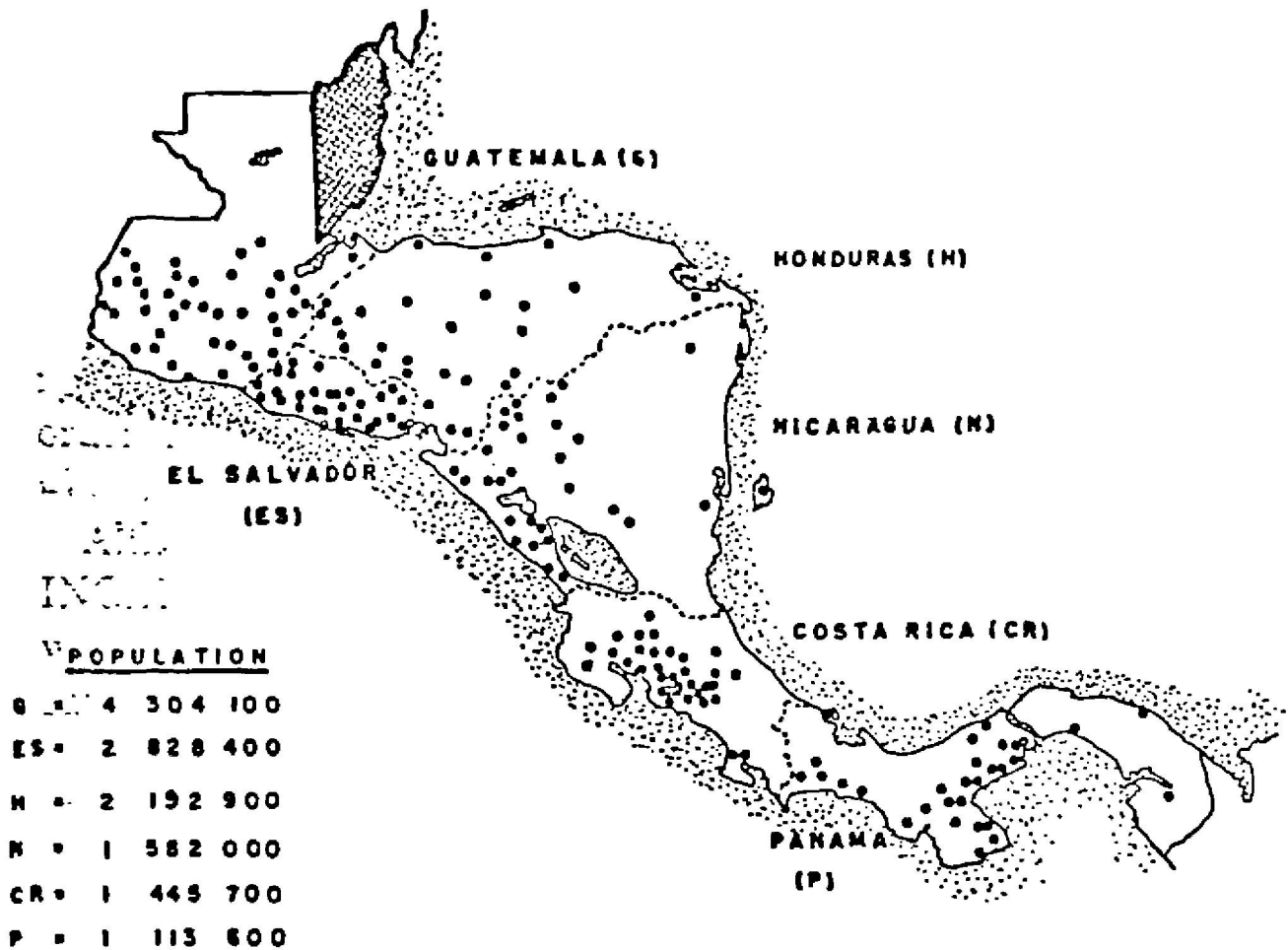


FIGURE 11.1. Map of the Central American countries and Panama.

ture; about one third of the total area is covered with plantations and from 70 percent to 75 percent of the labor force in most of the countries is involved in farming. Coffee is the main cash crop and sugar cane, the second. Bananas and other fruits, cash crops in the past, have been decreasing in the last decades; at present, cotton and livestock production have replaced part of those sources of national income. Grain production, mainly corn and rice, have increased markedly, but crops still are not sufficient even for domestic consumption in each country. The demand for corn as a cash crop has increased with the rapid expansion of the poultry industry. Especially in Guatemala, fruits and vegetables are produced and marketed fresh, a small proportion being distributed commercially to groceries for local demand or for export.

The annual *per capita* income of rural families in Central America varies between approximately \$150 for Guatemala, the lowest, to \$700 for Costa Rica, the highest; but real income decreases annually with inflation. In addition, land distribution in

these countries has decreased due to the effect of population growth. The annual population growth rate is from 2.9 percent, the lowest, in Nicaragua, to 4.1, the highest, for Costa Rica (Ramírez, 1969).

Guatemala is different from the rest of Central America from the ethnic point of view, because the population is divided into two groups, "Mayan Indians" (about 60%) and the so called "ladinos," those native Indians or mestizos who possess Spanish cultural traits. In the rest of the countries of Central America the predominant type of population is the "mestizo" with a great mixture with Negro or Caribbean groups, mainly in Nicaragua, Costa Rica and Panama. Very small isolated Indian groups can be found on the Atlantic Coast of Panama and in some sectors of Honduras and El Salvador; nevertheless, many cultural traits of the Mayan Indians survive in the people of the total area, except in Panama. The type of dwelling in rural areas (Figs. 11.2 and 11.3) does not differ greatly from country to country, the fireplace and furniture types having remained fairly similar throughout the centuries.

The total population, on the basis of the 1964 census was



FIGURE 11.2. A common type of dwelling in the rural areas.



FIGURE 11.3. Typical kitchen equipment of a rural family.

13,466,700, with the distribution presented in Figure 11.1, Guatemala having the largest population, 4,304,100 inhabitants.

A NUTRITIONAL SURVEY IN CENTRAL AMERICA

During the years 1965-67, a nutritional survey of all countries of Central America was carried out.* The clinical and biochemical data were obtained simultaneously with the dietary information which covered a period of three days applying the daily record method.

A representative sample of the total population (approximately 1/1,000) was drawn in each country. The field data were collected during only one season of the year in each country, but three of them represent the dry season and the rest the rainy season. The communities surveyed are indicated on the

* This research was supported by the Advanced Research Projects Agency (Project AGILE) and was monitored by the Nutrition Section, Office of International Research, National Institutes of Health, under ARPA Order No. 580, Program Plan No. 298.

map (Fig. 11.1) with small dots, giving a total of 192 towns. The choice of the communities for this survey was based on different criteria in each country, mainly with regard to concentration of the population, economic development and public health regions. Only towns with less than 25,000 inhabitants were considered, and for urban samples the capital cities were surveyed as a separate study.

The information was analyzed qualitatively to find out the food patterns of the populations, and quantitatively for nutritive value of the diets. Clinical and biochemical data were studied for the same groups to find out the relationship between food intake and nutritional status.

FOOD PATTERNS

Food patterns in the rural area of Central America consist mainly of a basic cereal, corn, prepared as *tortillas* which are consumed as daily bread with all meals; only in Panama corn practically disappeared and is substituted by rice. Such substitution for the *tortilla* begins in Nicaragua, where part of the corn is replaced by other calorie sources such as wheat bread and rice, or rice and bananas as occurs in all the Atlantic Caribbean groups. In Guatemala, corn is treated with lime water, to get rid of the cellulose as the ancient Mayans did, and the same technique is used in the rest of the countries. The lack of lime in some areas has forced the people to use wood ashes to prepare the alkaline water necessary to peel the corn. The yellow type of corn is preferred by the Mayan Indians, and white corn by *ladinos* or *mestizos* in all countries. The shape of the tortilla is always round but in Guatemala it is a thin layer of small size; in other countries like Nicaragua they are round thick cakes of large size. The product is always baked with the addition of water and nothing else, using a clay dish for the baking, except in Panama where they add some fat and prefer metal dishes for cooking.

Beans (*Phaseolus vulgaris*) of varying colors supplement the cereal diets in these countries, and they appear in the rural areas as the main dish in each of the three daily meals. The

usual way to prepare them is boiling the beans with salt and flavoring herbs or onions and garlic. Fats are added only among the more sophisticated families, except in Costa Rica and Panama, where they are used by all families. Guatemala, however, is the only place where people prepare the beans by boiling and sifting them, later they are mashed and fried with fat, becoming a delicate dish. In Costa Rica, Nicaragua and Panama people have a preference for red color beans, and sporadically use black or white.

When average amounts of foods consumed by families are obtained for each country, the characteristics of the food patterns stand out. Some foods are very important for some countries, according to the amounts in which they are consumed; for other countries the consumption is so low that the contribution to the total diet is unimportant. For instance, corn tortilla in Guatemala and El Salvador is consumed on an average of 500 g. per person, per day. The consumption decreases in the other countries, reaching only 46 g. per person, per day, in Costa Rica, and in Panama only 3 g. In these two countries rice is consumed in greater amounts, 90 and 180 g. in Costa Rica and Panama, respectively, while in Guatemala and El Salvador the average rice consumption is only 16 and 22 g. Rice appears at noon and evening meals in these countries, but preparation is different in Panama where great amounts of oil are added after the rice is cooked; in the other countries lard is used in small amounts and it is added before cooking the rice. There is a great influence of Asiatic food cooking practices in Panama and, therefore, they treat rice with a multiple washing which is very detrimental to the nutritive value of this cereal. Consequently, contribution of vitamins from rice is poor in Panama. This country has the lowest consumption of beans, 23 g. per person, per day, twice this amount is consumed in the other countries, while in Nicaragua consumption increases to 80 g.

A third item which appears in all diets is coffee generally sweetened with raw sugar. In the Guatemalan highlands coffee appears at each meal; in the lowlands as in the rest of the countries, coffee is replaced at noon by local beverages prepared with corn like "atole," "pinol," "tiste" or "chicha," or by carbonated

beverages as in Nicaragua and Panama. Costa Rican people have a special habit with regard to the consumption of raw sugar; it is dissolved in water and consumed as a refreshment all day long when men are working in the field. Consequently, consumption of sugars is high in this country, 90 g., as compared to the rest with 30 or 50 g. per person daily.

For most of the families the noon meal consists of soup prepared with beef and vegetables, called by a different name in each country, like "caldo," "sancocho," or "olla de carne," in which everything is boiled in one dish. In Panama such home-made soup has been replaced by inexpensive dehydrated soups, where flavor and nutritive content has deteriorated since it is an imported processed food. Beef is the most popular meat used in this typical dish but pork, when available, is preferred by "mestizos." Fish is consumed by Negroes or Caribbeans, or some small groups living near the sea or lakes. During Lent, fish becomes very important, but low availability and high prices make this food a holy dish only for families of better income. Total meat consumption in these countries is about 50 g. per person, per day, only Panama exceeds the average with 90 g.

Consumption of fresh vegetables differs greatly between Guatemala and the rest of Central America; Mayan Indians prefer wild green leaves collected in their own fields and different kinds of tomatoes with green or red peppers, all very common in the highlands where they live. For the rest of the countries the only vegetables consumed are the garden type: carrots, lettuce or *güisquiles* (*Sechium edule*) and green plantains; tomatoes and peppers are used in very minute amounts only to give flavor. Starchy roots and tubers are consumed more by the Negro population. In Panama for instance, plantains and starchy roots used in the soup reach average figures of 102 g. for plantains and 78 g. for starchy roots, while in Guatemala the corresponding amounts are 26 and 14 g. per person, per day. Coconut milk appears only in Panama, in the rest of the countries it is not used except by very small Caribbean groups on the Atlantic Coast.

Fruits do not constitute part of the diet of the Mayan Indians, but all kinds of tropical fruits are abundant in all areas. Other

population groups consume them with great frequency, not as part of a meal but between meals. Indians, however, produce large quantities of fruits as a cash crop since prices are very good in the city markets especially for fruits from the highlands, such as apples, peaches, plums, and pears. In the lowlands bananas, papayas, pineapples, mangoes and cashews are produced on the large farms that belong to "ladino" families.

Consumption of milk and dairy products is low in Guatemala and Panama (around 100 g. daily in terms of liquid milk per person). In Honduras the intake is about 200 g., while in Nicaragua and Costa Rica, due to greater availability, consumption of milk increases to 260 g. and is used commonly to prepare a kind of cheese called "cuajada." Availability of milk in Panama is higher than in the other countries, because there is a considerable importation of milk from the United States, mainly as sweetened condensed milk (appropriate for hot climates), but consumption is still low.

Another important item in the food pattern of Central American countries is wheat bread of two kinds, the sweet type like pastry and the French kind prepared without fat or milk solids. Spaghetti or other kinds of cereals like oatmeal, corn flakes, etc. appeared only in the city diets. Amounts of bread consumed are from 25 to 50 g., and for other processed cereals 1 to 6 g. per person, per day.

The consumption of fats changes from country to country, Guatemala having the lowest figure and Costa Rica and Panama the highest. In the latter oil is more commonly used than lard, which is the most popular fat in Guatemala and El Salvador. The average fat consumption in Guatemala per person is 8 g. daily, in El Salvador, Honduras and Nicaragua twice that amount, and in Costa Rica and Panama 25 g.

NUTRITIVE VALUE OF THE DIETS.

Physiologically speaking, nutrient intake levels are more important than food consumption and results obtained in each country, from a dietary survey applying the three-day daily record method, are given in Table 11.1. In order to compare the

TABLE 11 1
INTAKE/PERSON/DAY OF CALORIES AND NUTRIENTS IN
RURAL AREAS OF CENTRAL AMERICA AND PANAMA*

Components		Guate- mala	El Salvador	Hon- duras	Nicar- agua	Costa Rica	Pan- ama
Calories		1994	1911	1622	1826	1800	2002
Protein: total	g	60.4	59.5	51.6	57.7	49.2	57.2
animal	g	14.2	15.4	16.9	17.6	18.3	24.3
Fat	g	32.2	35.6	38.2	38.8	44.2	46.4
Carbohydrates	g	382	353	280	326	310	318
Calcium	mg	994	1065	740	725	579	292
Phosphorus	mg	1241	1206	1003	1106	917	571
Iron	mg	14.6	9.6	12.5	17.1	13.3	12.3
Vitamin A:							
retinol	μg	209	91	155	167	255	211
carotene	μg	962	282	452	792	730	762
Thiamine	mg	1.05	0.89	0.86	0.85	0.73	0.86
Riboflavin	mg	0.72	0.69	0.69	0.89	0.89	0.67
Niacin	mg	11.24	9.92	9.67	9.60	9.70	13.51
Vitamin C	mg	34	25	45	56	52	73

* Three-day daily record method.

ADEQUACY OF INTAKE LEVELS

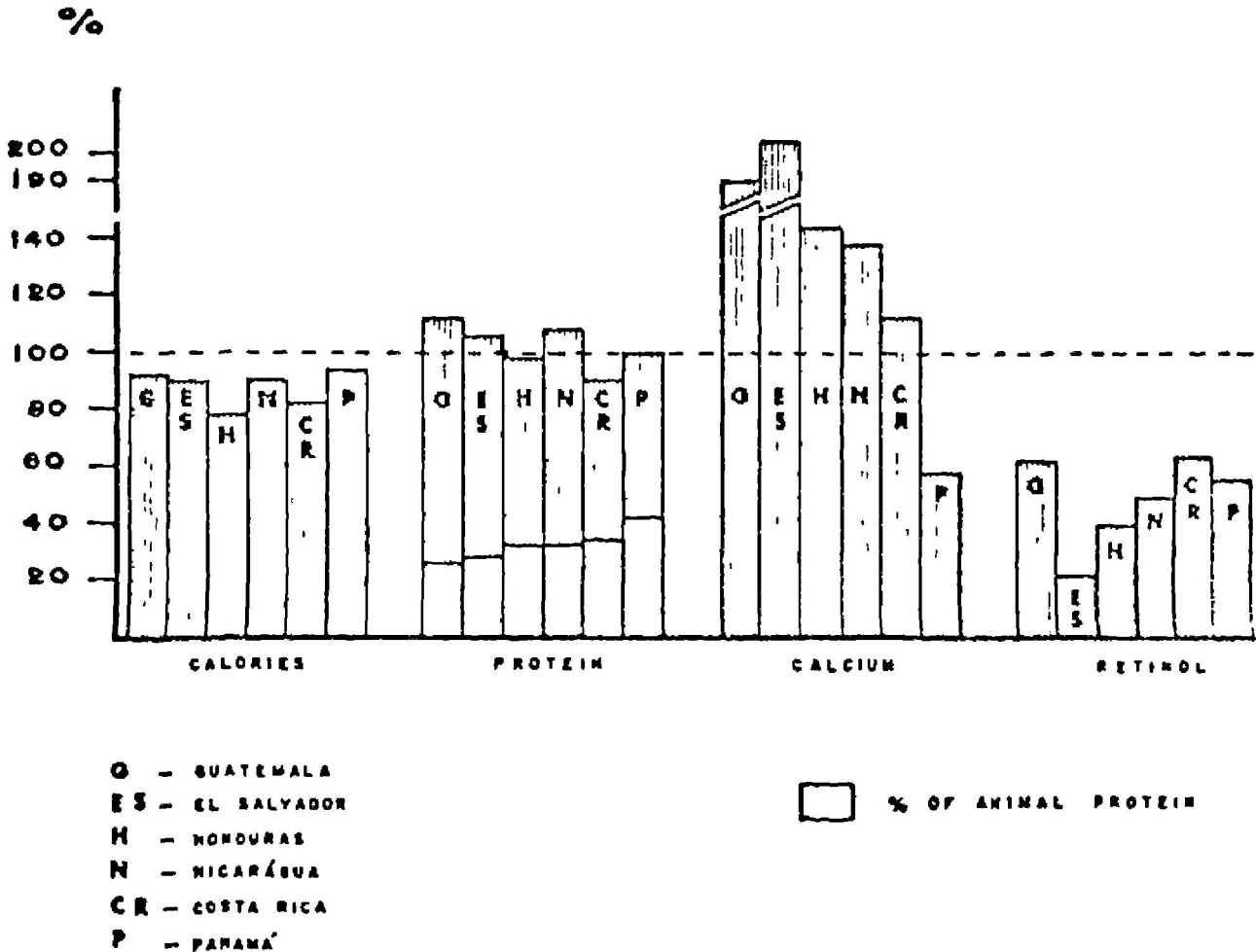


FIGURE 11.4. Adequacy of intake levels (calories, protein, calcium and retinol).

intake levels of the six countries more easily the results in terms of adequacy of intake levels are presented in Figures 11.4 and 11.5. To calculate the adequacy of the diet, recommended allowances were calculated for the populations on the basis of tables prepared by INCAP in 1969, which basically follow the FAO recommendations (Flores *et al.*, 1969).

Calorie intakes for Guatemala, El Salvador, and Panama reach the levels of 1900 and 2000, while in Honduras, the lowest intake reaches only 1600 and in Nicaragua and Costa Rica 1800 calories daily, per person. Comparing those intakes with estimated requirements (Flores *et al.*, 1969), it has been found that the levels in all countries cover 90 percent of the requirements, except in Honduras and Costa Rica where only 70 percent and 83 percent, respectively, are covered. Average figures do not show the actual distribution, but they suggest that part of the population in each country is affected by calorie deficiency, especially in Honduras.

The consumption of total protein is adequate in a great num-

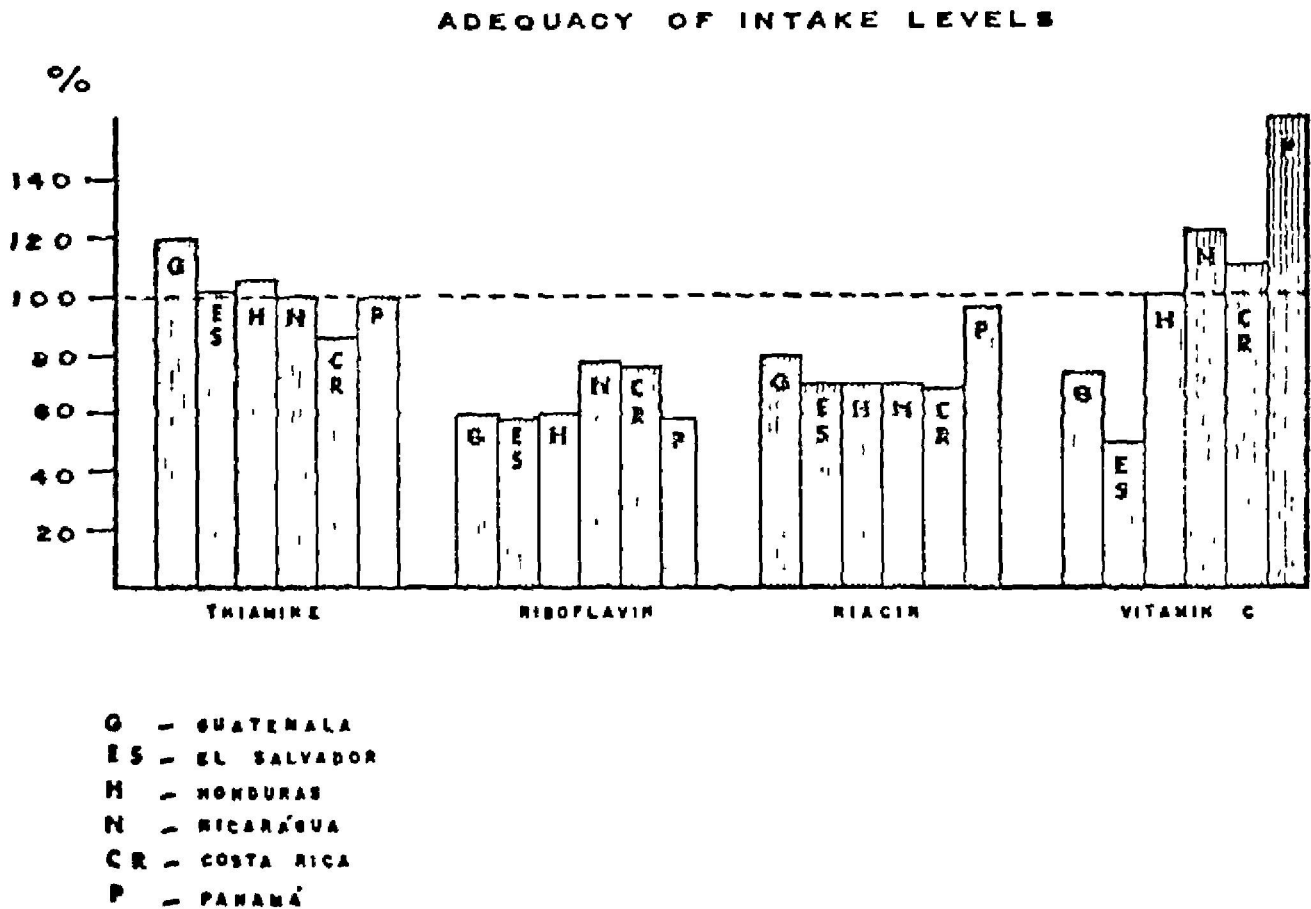


FIGURE 11.5. Adequacy of intake levels (thiamine, riboflavin, niacin and vitamin C).

ber of the families; average figures cover the recommended allowances with great amplitude. The proportion of animal to total protein, however, is low in all the countries except Panama, where it reaches 42 percent as compared to Guatemala with only 23 percent. In most of the countries there are families with intakes of animal protein between 0 to 3 g. per person, per day, and approximately in 50 percent of the total population the animal protein intake is between 5 to 15 g. Corn is the main source of protein, which is poor in essential amino acids and, therefore, of low biological value. Such a situation affects particularly children since they require more essential amino acids than adults, per unit of body weight.

Intakes of minerals on the basis of calculated values of the diets applying INCAP and Latin American food tables (Flores *et al.*, 1960; Wu Leung and Flores, 1962) appear adequate in calcium and iron for all countries, except for Panama where the intake of calcium covers only 57 percent, and in El Salvador where the intake of iron covers only 73 percent of the recommended allowances. The extremely high levels of calcium that the diets of Guatemala and El Salvador show (Fig. 11.4), are due to the calcium of the lime used in the process of preparing tortillas. In Honduras, Nicaragua and Costa Rica, as mentioned before, lime is replaced by wood ashes which contain only iron; therefore, calcium intake is low but sufficient to cover the recommendations. Consequently, there is only a slight possibility of deficiency of calcium in these countries. In Panama, where the average intake is very low, there is a great proportion of the population with extremely deficient intakes; but clinical signs of deficiencies are not found because of the high capacity of the human body to adjust physiological needs to a relatively low calcium intake by increasing the efficiency of utilization of this mineral.

The results for all countries show that there is a very serious deficiency in vitamin A intake (retinol), especially in El Salvador. Average figures for Vitamin A intake cover about 23 percent of the recommended allowances in El Salvador, and between 40 to 60 percent in the rest of the countries. Since carotene has also vitamin A activity, Guatemala and Costa Rica with a

relatively higher consumption of green vegetables rich in carotene, show a better retinol intake, which is still not sufficient to prevent deficiencies. The true situation of vitamin A intake in the total population is not revealed by those averages, but examining the distribution of the families, according to the intake, it is found that about 25 percent of the families have a *per capita* intake of approximately 17 percent or less of the recommended allowances. About 50 percent of the total population in all countries have intakes that cover scarcely one third of the recommended allowances of vitamin A.

Since corn and other cereals are good sources of thiamine and niacin, the amounts in which they are consumed provide the people of those countries with sufficient intakes of these vitamins so that deficiencies are not expected. In Costa Rica with its low consumption of corn, a small proportion of the population is likely to have some deficiency of thiamine. In the case of Panama the intake levels calculated with the food tables are not true values, because thiamine from rice is lost with the hard treatment of multiple washing. This problem was confirmed by the chemical analysis of food composite samples collected in this country.

Niacin may appear low in all countries when intake figures are compared with the recommended allowances, but when the niacin content of the diets was calculated, the precursor of niacin (tryptophan) was not considered. On the other hand, the recommendations include niacin and niacin equivalents; consequently, those figures are too high to be compared with intake levels.

The mean intakes of riboflavin show a deficit of approximately 30 percent; only in Nicaragua and Costa Rica average intake levels cover at least 75 percent and 77 percent of the recommended allowances, because of a higher consumption of milk and milk products. Riboflavin is abundant only in milk and the scarcity of the product affects the total population with respect to this vitamin. Such low average figures suggest that there is in each country a large proportion of families with intakes covering only a very small portion of the recommended allowances.

Finally, the average intakes of vitamin C show that there is an abundance of this nutrient in the diets, especially in countries

like Panama and Nicaragua with hot climates, where fruits rich in vitamin C are available in large quantities. In addition, in countries like Nicaragua, Costa Rica and Panama, where the consumption of roots, tubers and bananas is high, contribution of these foods to the vitamin C intake is also very important. In Guatemala and El Salvador, on the contrary, most of vitamin C comes mainly from vegetables; therefore among the Indians one finds a proportion of the population with very low intakes, especially during the dry season, when green vegetables are scarce.

CLINICAL AND BIOCHEMICAL FINDINGS

The dietary deficiencies found among the rural people of Central American countries are confirmed by the biochemical findings and by some of the clinical observations.

Limitations in protein and calorie intake result in growth retardation of the people in the whole region. It is found that at the age of three months, in all these countries, the average weight and height of children compared with the standards adopted by INCAP (Jackson and Kelly, 1945), already show some deviation. In general, all preschool children of the rural areas, at six months, show weights and heights already below standards and at twelve months the deviation is so marked that they have values equivalent to a child of seven months; at the age of two years they have weights and heights of a normal child of one year and at five years of age all children are one and a half or two years behind the standards. Because of the critical rapid growth at preschool age the expected height or weight, by age, is not attained and retardation remains for the rest of the life. At the age of twenty-five years the average weight for all countries is 55 kg. for men and 50 kg. for women, and 160 cm. of height for men and 150 cm. for women.

Retardation in growth of head circumference is even greater than that of height and weight among children. At five years, this circumference corresponds to the size of a normal child of three years. The reason may be that the head size increases much more rapidly than other parameters, during infancy and early childhood.

In each country few cases of marasmus and kwashiorkor (Fig. 11.6) or of acute stages of malnutrition are found in the samples surveyed. A great proportion of children, about 20 per cent, are found to have some degree of protein-calorie defi-

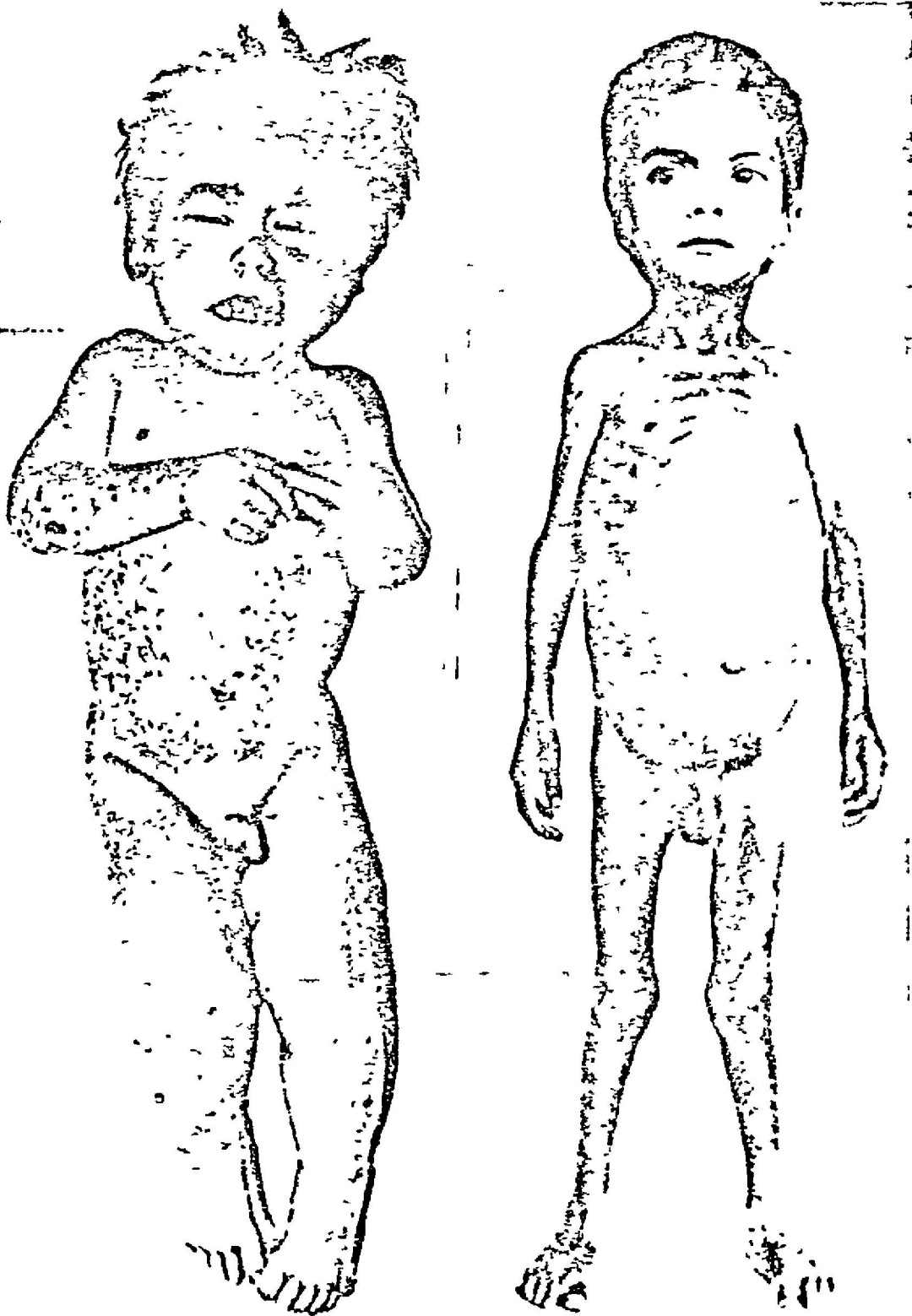


FIGURE 11.6. Two cases of protein-calorie malnutrition *Left* Kwashiorkor, *Right*: Marasmus. (Taken from Scrimshaw, N. S., and Béhar, M.: Protein malnutrition in young children *Science*, 133 2039, 1961. Copyright 1961 by the American Association for the Advancement of Science).

ciency, evidenced in some clinical signs such as hair changes or edema. With regard to biochemical values, the ratio of plasma nonessential/to essential amino acids also confirms the unfavorable situation of rural children. About 25 percent of children 0 to 4 years of age have ratios of 3.0 or higher, and a ratio of 3 indicates a severe protein deficiency according to Whitehead and Dean (1964).

Concentrations of vitamin A in the plasma showed a significant prevalence of deficient values ($< 10 \mu\text{g}/100 \text{ ml}$), and low values (10 to $19 \mu\text{g}/100 \text{ ml}$) are found in about 20 percent of the population. The data analyzed by age groups indicate that children are particularly affected by this deficiency. Nevertheless, in these countries only follicular hyperkeratosis is found in a very small percentage (0.6%) of the population and keratomalacia or xerophthalmia are not observed.

With regard to riboflavin, judging by the urinary excretion values, it is found that in a rural sample about 25 percent of the total population fall into the low value and about 3 percent in the deficient category. The deficient intakes are severe enough to result in a significant reduction of red blood cell riboflavin. About 20 percent to 30 percent have low values and from 3 percent to 5 percent deficient levels. Some clinical deficiencies are observed in about 3 percent of the population in most of these countries.

The hematological studies show some deficient values in hemoglobin and hematocrit, suggesting a moderate prevalence of anemia in Central America, the population group most affected living below 2,500 feet above sea level. Again, the highest prevalence of anemia is found in children under one year and in pregnant women during the third trimester of pregnancy. Besides the iron deficiency, low serum values of folic acid are found in about 19 percent of the sample.

In some areas of the Central American countries and Panama lack of iodine has produced goiter with a prevalence of 18 percent for most of the countries. In El Salvador the prevalence is still higher, while Guatemala at present has the lowest prevalence (5%), due to the iodization of salt which has been compulsory in the whole country since 1957. Figure 11.7 shows one of the



FIGURE 11.7. A case of goiter.

cases observed some years ago in Guatemala. The highest prevalence is found in females, especially among adolescents; deficiencies are confirmed by urinary excretion which was less than $25 \mu\text{g}$ per day in most cases.

Finally, problems of prevalence of intestinal parasites, mainly helminths, are found in all countries; the rates of infestation increase progressively with age, from the first year of life. The most commonly found are *Ascaris*, *Trichuris* and hookworm, in about 50, 18 and 6 percent of the population, respectively. There is also a high prevalence of *Entamoeba histolytica* and other protozoa in children at early ages which results in diarrheal diseases and become another precipitating factor of malnutrition.

FAMILY FOOD DISTRIBUTION

Most of the biochemical findings show that the preschool child is the most affected member of the family, in relation to the nutritional status. The highest prevalence of deficient values are always likely to appear in children from 0 to 4 years, due

to the fact that his rapid growth requires two or three times more of the nutritive substances than the adults, even if he gets the best quality foodstuffs available in the family.

The situation is aggravated when most of the foods available at home are given to the different members of the family according to a cultural pattern, and the portions that each one receives are not equal. The child receives the smallest share due to his limited capacity to compete with other members of the family, and because of his food preferences are still undeveloped.

To illustrate more clearly the food share that the small child receives at the family level, Figure 11.8 presents the results obtained for the rural area of Guatemala with regard to nutrient intake as compared with the recommended allowances for the

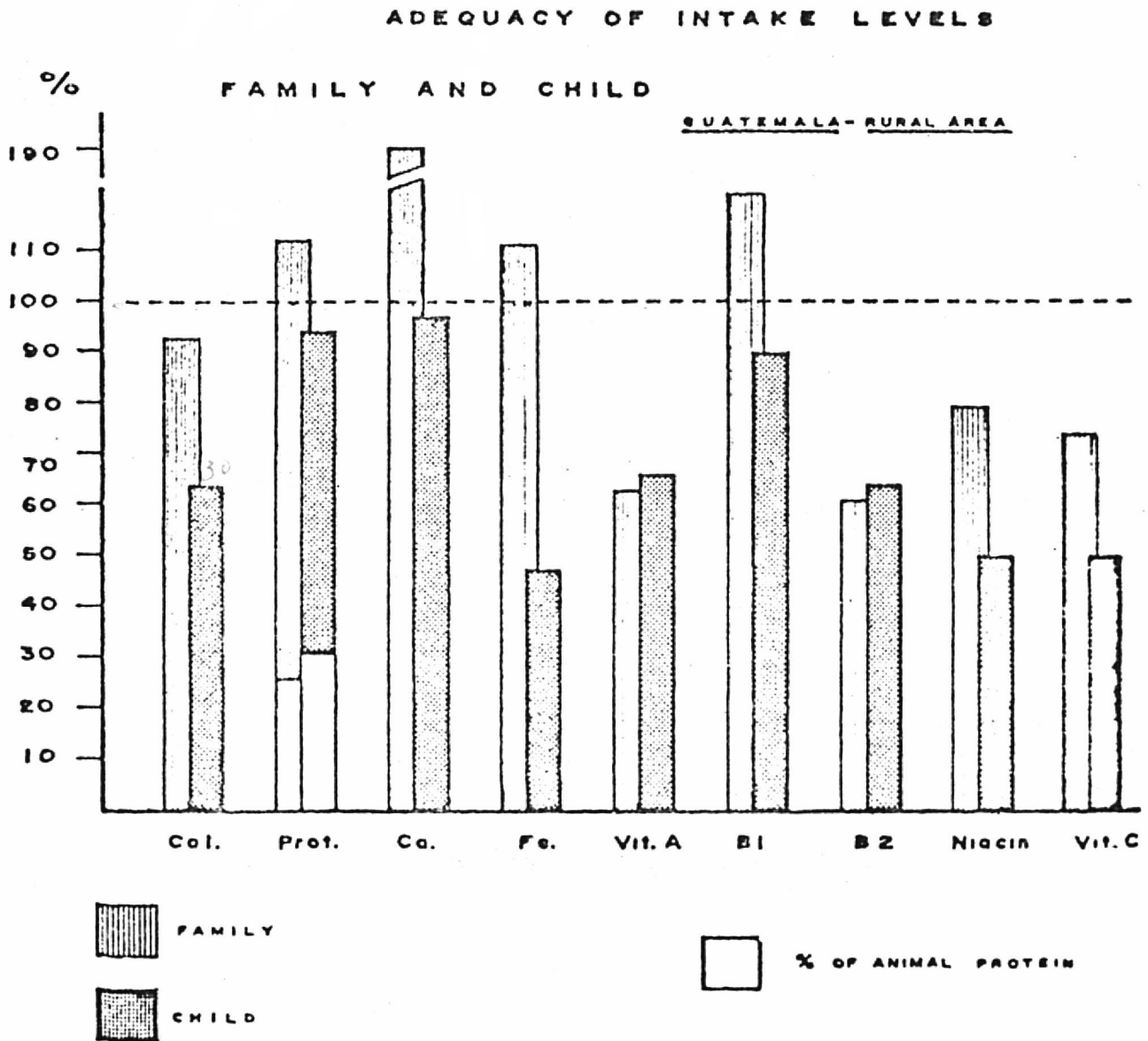


FIGURE 11.8. Adequacy of intake levels—family and child.

family and child. The study was planned specifically to find out whether there is a relation between child intake and availability of nutrients at the family level, similar to other previous studies carried out among Indian groups (Flores *et al*, 1964). Family and child were studied during three days, measuring the total family and individual child intake in the whole sample of the rural Guatemalan population.

For those nutrients like calories, protein, calcium and thiamine derived mainly from corn, deficiencies at the family level are not expected because of the sufficient amounts in which corn is consumed in Guatemala. Figure 11.8 shows that the average covers the calorie needs for the family adequately. For the child the situation is different, even for those nutrients; the average intakes per child do not cover the recommended allowances, reaching levels with a deficit of 35 percent for calories and 5 or 10 percent for protein, calcium and thiamine. Iron intakes among families, where the main sources are fresh vegetables, reach levels sufficient to cover the recommended allowances per person in the family, but for the child the average level is very inadequate; the main cause is that no appropriate iron supply for the child exists in the family, resulting in such dietary deficiency.

For those nutrients of which the whole family suffers a deficiency, like vitamin A and riboflavin, children received equal or perhaps a little higher share; but the deficiency is more significant and critical at such age and can precipitate a serious deficiency. Preventive measures to avoid this problem are urgently needed in this region, such as increasing the production of appropriate children's foods, at low prices, and intensive nutritional education programs in the rural areas.

SUMMARY

From the evaluation of the diets it may be concluded that there is a portion of the population affected by calorie and protein deficiencies. In addition, the protein of the diets is of low nutritive value, since corn is the main source of such nutrient and is very poor in essential amino acids. Another serious dietary

deficiency observed was the low vitamin A (retinol) intake, which was confirmed by biochemical and clinical findings. Low serum values of vitamin A were predominant in all population groups.

Growth retardation and the presence of severe cases of protein malnutrition among preschool children in the whole region are the result of those deficiencies. Other moderate deficiencies are low values of riboflavin intake confirmed by low values in the urinary excretion of this vitamin, and iron deficiency which is one of the factors responsible for the prevalence of anemia in Central America.

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