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Nutrition in the 1980s: Constraints on Our Knowledge, pages 271–282

Nutritional Status in Central America and Panama

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The general nutritional condition of populations in developing nations is likely to be modified by programs that affect income and prices and, thereby, influence the kind and quantity of food available to families, or by programs that provide primary health care, potable water, or improved housing conditions. Such programs are largely a part of government-directed development programs.

Certain nutritional deficiencies can be eradicated in spite of a lack of improvement in the living conditions of deprived families. In other words, some specific nutrient deficiencies (ie, iodine, vitamin A) may be attacked successfully by the so-called specific interventions.

Important political, economic, and social events have occurred in the six countries of the Central American isthmus during the last 15 years. These events have had, or will have, important effects on the nutritional conditions of the populations. This paper examines the present nutritional status, the changes in Central America and Panama during the past 15 years, the regional and socioeconomic distribution of malnutrition, and the outlook for the 1980s.

NUTRITIONAL DEFICIENCIES

The national nutrition surveys conducted in these six countries in 1965–1967 [1] identified protein-energy malnutrition (PEM), hypovitaminosis A, iron- and folate-related anemias, and iodine deficiency as the most serious nutritional problems affecting the study populations. To a lesser extent, deficiencies of riboflavin and thiamin were also identified. The kind and magnitude of nutritional problems vary from country to country, with the problems in general being most serious in Guatemala, El Salvador, and Honduras and of lesser magnitude in Nicaragua, Costa Rica, and Panama [1].

Vitamin and Mineral Deficiencies

The technology to fortify common salt with iodate was developed by the Institute of Nutrition of Central America and Panama (INCAP) and implemented

in Guatemala in 1956. It was later implemented in Costa Rica, Panama, Honduras, El Salvador, and Nicaragua. Guatemala and Costa Rica are the only two countries in the area where data on the prevalence of goiter, before and after the iodization program, are available.

The 38% prevalence of goiter found in Guatemala in 1954 [2] was reduced to 5% in 1965 [1], that is, nine years after the initiation of salt fortification in 1956. Salt was first iodized in Costa Rica in 1971; the 18% prevalence of goiter found in 1966 was decreased to 4% in 1979 [3]. In both countries, goiter has been eradicated as a public health problem, and similar results are expected in the other four countries of the region where salt is also being iodized.

Research aimed at finding a short-term solution to hypovitaminosis A identified in the 1965–1967 surveys was initiated at INCAP in 1969. The technological constraints of adding vitamin A to white sugar were overcome in the early 1970s [4]. The Costa Rican and Guatemalan governments passed laws in 1974 requiring the fortification with vitamin A of all sugar for domestic consumption; Honduras and Panama passed such laws in 1976 [5].

Serum retinol values were measured in Costa Rican children under five years of age before and after four years of consumption of sugar fortified with vitamin A. "Deficient" (< 10 μg/100 ml) and "low" (10 to 19 μg/100 ml) levels of serum retinol were found in 32% of children studied in 1966 [1], while in 1979 the proportion of children in the same categories was only 2.3% [6].

INCAP embarked upon a comprehensive program for monitoring the impact of sugar fortified with vitamin A on rural Guatemalan communities [7]. Serum retinol levels were determined in children in 1965, again in 1975 just before the fortification started, and on two occasions in 1977 (end of dry season and end of rainy season), two years after the fortification was initiated [1,7]. In 1965, 26.2% of children had low and deficient values, and 21.5% were found in the same categories in 1975 ($P > 0.05$). The results of surveys conducted in 1977, however, showed that the proportion of children with serum retinol values below 20 μg/100 ml was only 11.1% in the dry season and 9.2% in the rainy season. These figures are significantly lower than those found in 1975 ($P < 0.01$) and 1965 ($P < 0.01$).

Information on serum retinol levels of children 12 to 72 months of age is also available from national surveys conducted in El Salvador in 1966 and 1976 [1,8]. The percentage of children with deficient and low levels of serum retinol was 50.0% in 1966, while the corresponding percentage found in 1976 was 33.3% ($P < 0.01$). Sugar fortified with vitamin A is not available in El Salvador.

Because of the marked improvements observed in survey results in 1979, the Government of Costa Rica is considering the possibility of discontinuing the program and monitoring serum retinol levels in future years. Honduras has been efficiently fortifying sugar with vitamin A since 1978, and it is expected that El Salvador and Nicaragua will implement similar programs in the near future.

Panama carried on fortification for two years but interrupted the program due to administrative and financial constraints.

There is no information available with which to ascertain the present conditions of the population of the six countries with reference to anemias and riboflavin and thiamin deficiencies.

Protein-Energy Malnutrition

Mortality and morbidity as well as growth retardation indicators reflect existing protein-energy malnutrition levels, but are commonly confounded by simultaneous vitamin and mineral deficiencies.

Specific indicators of chronic and moderate PEM that can distinguish PEM from other nutritional deficiencies have not yet been identified. Growth retardation indicators and vital statistics are now generally accepted for use in evaluating the extent and severity of PEM. There is overwhelming evidence that the major nutritional components underlying these impairments are deficiencies of energy and protein.

Statistics on infant mortality for these six countries during the period 1965 to 1975 are presented in Table I. Information available for 1976, 1977, and 1978 from some countries is also included. The data show that important reductions occurred from 1965 to 1978, particularly in Costa Rica and Panama, where infant mortality of 69.3‰ and 44.7‰ in 1965 dropped to 24‰ and 25‰, respectively, in 1978.

Guatemala also had marked reductions in infant mortality between 1965 and 1977, and improvements of lesser magnitude were observed in El Salvador, Honduras, and Nicaragua.

Improvements in infant mortality in Costa Rica and Panama have been greater in rural than in urban areas [10,11]. In Costa Rica, none of the 80 county seats *(cantones)* into which the country is politically and administratively divided had infant mortality above 45‰ in 1978.

Infant mortality during the period in which data were available for each country decreased as follows: 3.44 deaths per year per 1,000 births in Costa Rica from 1965 to 1978; 1.66 in Guatemala from 1965 to 1977; 1.35 in Panama from 1965 to 1978; and 1.10, 0.76, and 0.17 in El Salvador, Nicaragua, and Honduras, respectively, from 1965 to 1975.

Information on mortality of one- to four-year-olds for the six countries is given in Table II. The reduction of these death rates in all countries is greater than that of infant mortality. The rate reported for Guatemala in 1965, 33.5‰, decreased to 21‰ in 1976. In El Salvador the corresponding change was from 15.5‰ in 1965 to 6.4‰ in 1975, while in Panama the rate of 7.5‰ in 1965 dropped to 2.0‰ in 1978. When the annual drop in mortality in one- to four-year-olds is estimated through regression analysis, the yearly decline is 1.18 in

TABLE I. Infant Mortality in Central America and Panama, 1965–1978 [9–11]

Year	Country					
	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panamá
1965	92.6	70.6	41.2	51.6	69.3	44.7
1966	89.0	62.[illegible]	37.8	55.4	65.1	45.0
1967	86.7	[illegible].1	35.5	45.4	62.3	42.7
1968	92.0	59.2	34.0	45.5	59.7	39.6
1969	91.3	63.3	36.5	45.3	67.1	39.9
1970	87.1	66.7	33.2	42.8	61.5	40.5
1971	81.6	52.5	39.5	45.0	56.4	37.6
1972	80.0	58.3	43.0	42.0	54.4	33.6
1973	79.9	59.1	39.8	47.6	44.8	33.3
1974	[illegible].4	53.4	34.1	41.2	37.6	31.5
1975	81.0	58.1	33.7	46.4	37.9	31.0
1976	76.3	—	—	—	33.3	36.8
1977	69.8	—	—	—	27.2	—
1978	—	—	—	—	24.0	24.8

Guatemala, 0.78 in El Salvador, 0.51 in Nicaragua, 0.48 in Costa Rica and Panama, and 0.46 in Honduras.

Figure 1 shows the prevalence of malaria in Panama during the period 1972 to 1978 [11]. A total of 913 cases of malaria was reported in 1972, and this was reduced to 263 cases in 1978.

Figure 2 presents the morbidity due to whooping cough reported in Costa Rica during the period 1965–1975 [10]. Reduction in morbidity from other diseases is reported in Costa Rica and Panama [10,11].

Information on growth retardation in children less than five years of age is available from national surveys conducted in the last five years in Costa Rica, Guatemala, and El Salvador. Retardation was ascertained by anthropometric measurements.

In the context of this paper, a child with height retardation is one who has a height for age below 90% of the 50th percentile of heights of children of the same age and sex from the Iowa standard [14]. A child with weight retardation has a weight for age relationship below 75% of the 50th percentile of the Iowa standard.

Costa Rica

The proportion of Costa Rican children 0 to 60 months of age with height retardation in 1966 was 16.9% [1]; 7.2% in 1975 [11]; and 6.8% in 1978 [13]. The differences in prevalence of height retardation, when the 1966 results are compared with the 1975 and 1978 values, are statistically significant ($P < 0.01$).

TABLE II. Mortality in One- to Four-Year-Olds in Central America and Panama, 1965–1978 [9–11]

Year	Country					
	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panamá
1965	33.5	15.0	13.3	8.4	6.9	7.5
1966	31.0	13.6	13.0	8.0	6.3	7.9
1967	28.3	12.1	12.7	—	6.1	7.4
1968	31.6	10.9	13.0	8.8	4.6	7.4
1969	33.9	13.9	13.3	9.5	6.0	8.3
1970	27.0	13.0	11.4	9.5	4.4	7.6
1971	29.2	8.7	8.6	—	4.0	7.0
1972	22.6	10.4	10.2	5.4	4.0	5.6
1973	22.3	9.5	10.1	5.7	3.0	5.8
1974	21.7	6.5	9.9	3.4	2.0	4.6
1975	22.6	6.4	9.2	—	2.2	3.3
1976	21.0	—	—	—	1.7	2.9
1977	—	—	—	—	1.3	—
1978	—	—	—	—	—	2.0

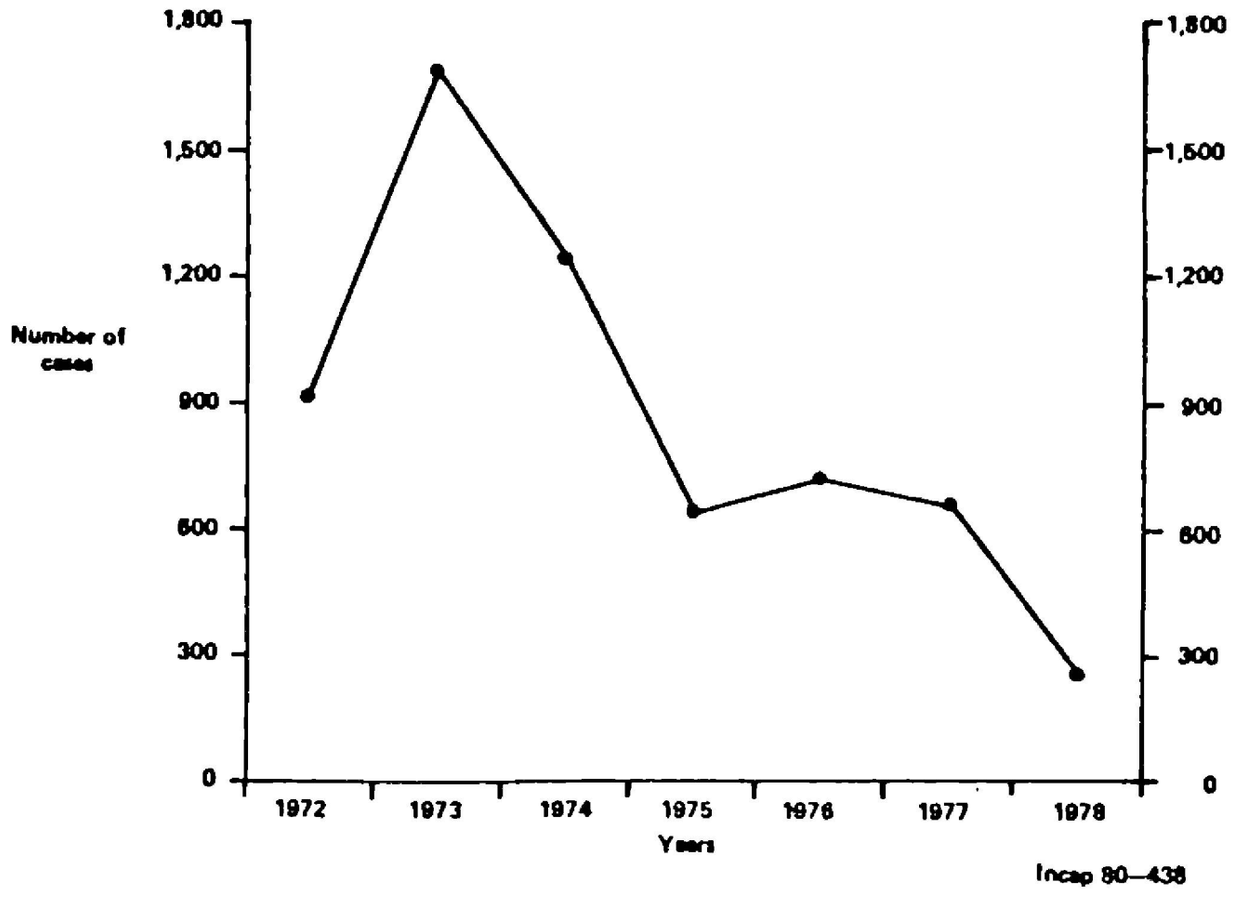

Fig. 1 Cases of malaria in Panama, 1972–1978.

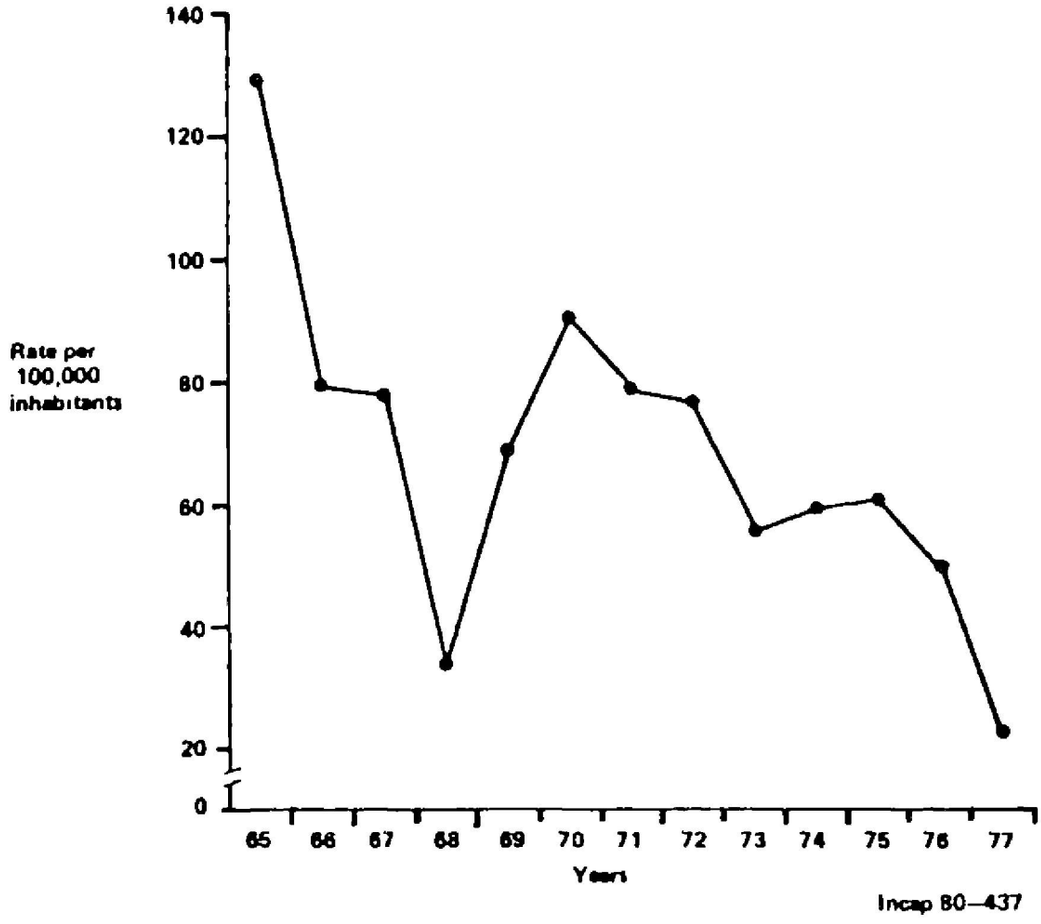

Fig. 2 Whooping cough in Costa Rica, 1965–1977. Rates per 100,000 inhabitants.

The percentage of Costa Rican children exhibiting weight retardation in 1966 dropped from 13% to 12.3% in 1975 ($P > 0.05$). Greater reductions were observed in 1978, when only 8.6% of the study children were classified as weight retarded. The differences in weight retardation found in 1978, when compared with previous findings, are significant ($P < 0.05$).

El Salvador

In El Salvador, the percentage of children with height retardation in 1965 was 48.5%, and the corresponding value for the children studied in 1976 was 34.0% [1,15]. The difference is statistically significant ($P < 0.01$). The percentage of children with weight retardation in 1965 was 27.5% and dropped to 22.6% in 1976 ($P > 0.05$).

Guatemala

Guatemala also has anthropometric data for children six to 59 months of age collected in national surveys conducted during the dry seasons of 1965 [1], 1976 [16], and 1977 [16]. There were 54.8% of children with height retardation in

TABLE III. Protein and Energy Intake ($\bar{x}$ Per Person) of Rural Families Studied in National Surveys in Three Countries

Country	Survey year	Sample size (families)	Energy (kcal)	Protein (gm)
Guatemala [1]	1965	203	2,117	68.0
Guatemala [17]	1976	360	1,637	51.2
El Salvador [1]	1965	293	2,146	67.9
El Salvador [17]	1976	420	1,732	55.1
Costa Rica [1]	1966	150	1,894	53.6
Costa Rica [26]	1978	160	2,067	54.0

1965, 49.0% in 1975, and 46.0% in 1977. The differences in height retardation for 1965 and 1975 ($P < 0.05$) and 1965 and 1977 ($P < 0.01$) are statistically significant.

Differences in weight retardation in the three surveys analyzed were not significant ($P > 0.05$). In 1965, 33.6% of children were below 75% of weight for age; in 1976, 34.6%; and in 1977, 30.5%.

Information on family protein and energy intakes gathered in national food consumption surveys in Guatemala, El Salvador, and Costa Rica from 1965 to 1978 is given in Table III. While increases in family energy and protein intakes are seen in Costa Rica, in Guatemala and El Salvador the mean energy and protein intakes are lower in more recent surveys than in 1965–1966.

REGIONAL AND SOCIOECONOMIC DIFFERENCES IN NUTRITIONAL STATUS

Recent nutritional studies in the isthmus have focused on identifying the nature and extent of malnutrition with regional and population-type specificity.

Table IV presents the results of anthropometric studies conducted in various regions of El Salvador in 1976 [18]. There are important regional differences in growth retardation. For example, 51.8% of the children residing in coffee-growing areas were height retarded, while in a coastal cotton- and sugar-growing region and the urban slums of the city of San Salvador, the prevalences were 37.1% ($P < 0.01$) and 33.4% ($P < 0.01$), respectively.

Differences in prevalence of malnutrition by county seats were identified in the census of children's height conducted by the Nutrition Information System (SIN) of Costa Rica, as shown in Figure 3 [19].

In 16% of the *cantones*, more than 20% of the children showed height retardation, while in 24% of the *cantones*, less than 10% of children suffered from height retardation. Only two *cantones* were found to have height retardation in less than 5% of the children.

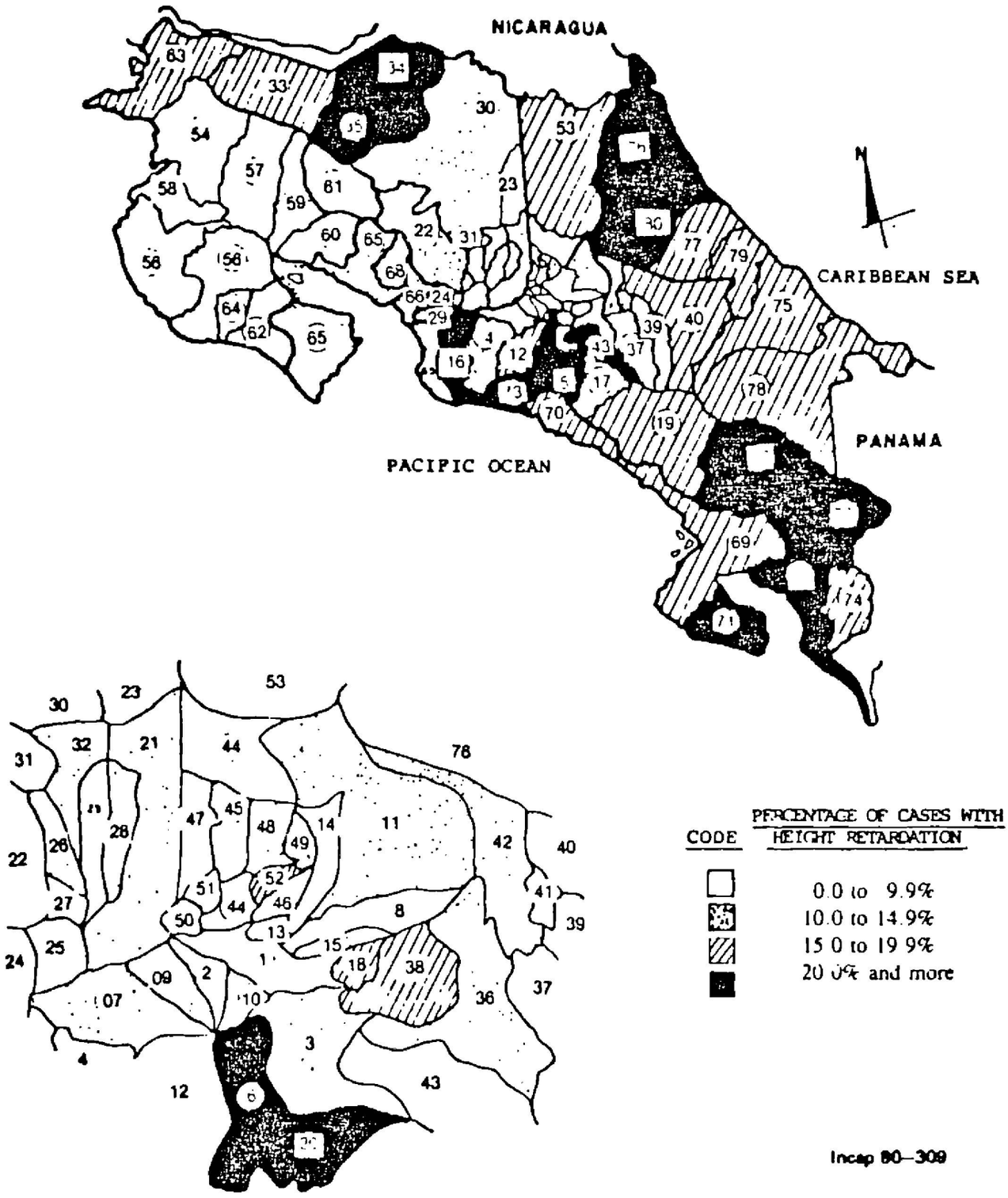

Fig. 3 Prevalence of height retardation in school children six to nine years of age by canton. Costa Rica, 1979.

The prevalence of weight retardation in children of different family types residing in four subsistence communities in rural Guatemala was reported in 1977 [20]. Table V shows the prevalence of weight retardation in children two and three years of age whose parents were dedicated to different occupations.

TABLE IV. Regional Differences in Growth Retardation in Children Six to 59 Months of Age in El Salvador, 1976 [18]

Regions	Sample size	Percentage of children	
		Below 90% of height for age	Below 75% of weight for age
Coffee	1,043	51.8	22.6
Subsistence (Central)	1,047	46.2	24.9
Subsistence (North)	1,477	39.6	22.7
Cotton and sugar (Coastal)	1,504	37.1	16.3
Urban slums	1,369	33.4	15.3

TABLE V. Prevalence of Weight Retardation in Children Two to Three Years of Age From Families in Different Occupations in Four Rural Villages of Eastern Guatemala

Group	Sample size	Percentage of cases with weight retardation
Farmers with access to less than 2 manzanas of land[a]	37	37.8
Farmers with access to 2 to 4.9 manzanas of land	74	31.1
Salaried agricultural workers	43	27.9
Skilled workers and merchants	39	17.9
Farmers with access to 5 or more manzanas of land	36	16.7

[a]One manzana = 0.7 hectare.

While this analytical approach provides valuable insight for identification of families at high risk of having undernourished children, a cause-effect relationship between land availability and nutritional status should not be assumed. Definite answers will be provided by comprehensive evaluations of efforts to

provide landless families with land and services integrating them into the national economy. Findings similar to those from the four Guatemalan villages are now available for national and regional levels of Costa Rica and Guatemala [21,22].

DISCUSSION

The available evidence on the kind and magnitude of nutritional deficiencies in the Central American isthmus shows marked differences in nutritional conditions among the six countries.

The application of technology by governments has dramatically reduced the prevalence of deficiencies arising from low iodine and vitamin A intakes. Research aimed at developing feasible technology for the fortification of an appropriate food vehicle with iron [23] is well advanced at INCAP. When this technology is applied, it is hoped that the prevalence of iron deficiency anemia will be reduced as successfully as that of goiter and hypovitaminosis A.

Mortality data collected in developing nations have serious problems of underreporting, which may be as much as 41% for infant mortality in some countries [9]. It is likely that the more recent figures will be of better quality—that is, the degree of underreporting will be lower. If this is the case, long-term comparisons of mortality may result in underestimation of real improvements occurring in the population.

The use of different sample frames in the anthropometric studies of the 1960s and 1970s precludes the possibility of drawing clear-cut conclusions about changes in children's growth. There is no basis, however, for suggesting that nutritional conditions have deteriorated during the last 15 years. In fact, the latest information on height retardation in Guatemala, Costa Rica, and El Salvador indicates that present prevalences are significantly lower ($P < 0.01$) in the three countries.

In planning food and nutrition programs, it is more important to know the total number of children suffering from malnutrition than the prevalence, since the total number determines the magnitude of resources to be allocated in various programs. When the 1965 and 1977 prevalence rates were applied to the total population in Guatemala, there were 111,459 more children suffering height retardation in 1977 than in 1965. In El Salvador, however, there were only 1,995 more cases of weight retardation in 1976 than in 1966; and in Costa Rica there were 22,100 fewer cases in 1978 than in 1965. The increase of cases in Guatemala and El Salvador represents 27% and 0.8% of the 1965 figures, while the drop in Costa Rica is on the order of 45% of the 1966 findings.

When analyses of nutritional status trends are made, growth retardation and mortality information should not be considered separately. When direct improvements in the nutritional conditions of a population are achieved through delivery of primary health care services and improvement of environmental conditions,

an increase in the proportion and total number of undernourished children may be expected, given that those who would not have survived without these services tend to have the worst nutritional status. This has been seen in field studies in India and Bangladesh [24,25].

Any changes in the nutritional situations of these populations, even that of Costa Rica, are likely to be the result of improvements, in scattered rural communities, of factors that determine food consumption and the utilization of energy and nutrients by individuals—ie, primary health care, potable water, waste-disposal systems. To a lesser extent, improvements in the family purchasing power would also contribute to these changes.

It is expected that, as a result of recent political changes in some countries or national strategies aimed at preventing them in others, large-scale programs to improve the purchasing power and environmental conditions of deprived families are likely to be implemented in the present decade.

The present political conditions, the focus of research activities, the availability of qualified professionals, the organization of local groups dedicated to food and nutrition planning activities, and the increased interest in monitoring nutritional status and related socioeconomic problems suggest that the prevalence and total number of undernourished individuals should be reduced substantially in the Central American isthmus in the 1980s.

REFERENCES

1. U.S. Department of Health, Education and Welfare: "Nutritional Evaluation of the Population of Central America and Panama. Regional Summary." INCAP/CDC. U.S. Department of Health, Education and Welfare, 1972.
2. Muñoz JA, Pérez C, Scrimshaw NS: Distribución geográfica del bocio endémico en Guatemala. Rev Col Med (Guatemala) 6:36–43, 1955.
3. Flores M, López ME, Santisteban I, De Céspedes C: Epidemiología del bocio endémico en Costa Rica.(in preparation).
4. Institute of Nutrition of Central America and Panama: "Fortification of Sugar with Vitamin A in Central America and Panama." Guatemala: Institute of Nutrition of Central America and Panama, 1974.
5. Government of Costa Rica, Presidential Agreement 3702-SPPS (19 April 1974); Government of Guatemala, Decree No 56-74 (11 June 1974); Government of Honduras, Decree No. 385 (28 September 1976), Government of Panama, Law No. 66 (9 December 1976).
6. De Céspedes C: INCIENSA, Costa Rica (personal communication).
7. Arroyave G, Aguilar JR, Flores M, Guzmán MA. "Evaluación del Programa Nacional de Fortificación de Azúcar con Vitamina A." Publicación Científica 384. Washington, DC: Pan American Health Organization, 1979.
8. Ministerio de Salud Pública y Asistencia Social. Instituto de Nutrición de Centro América y Panamá: "Evaluación de la Adecuación de Vitamina A en la Población Salvadoreña." Guatemala: INCAP, 1976.
9. Teller C, Díaz E: "Catálogo de Datos Demográficos para la Planificación Alimentaria Nutricional en Centro América y Panamá." Guatemala: INCAP, 1980.

10. Ministerio de Salud y Ministerio de Planificación: "Costa Rica: Extensión de los servicios de Salud. Documento presentado en la Conferencia Internacional sobre atención primaria de la Salud." Alma-Ata, U.S.S.R., 6–12 Septiembre de 1978.
11. Panama Ministry of Health: "La Salud Panameña en Cifras: 1978." Panama: Ministerio de Salud, 1979.
12. Díaz C, Córdova M, García P, Quirós J: Encuesta nutricional en Costa Rica. Rev Med Costa Rica. XLIV No. 460 Tomo XXXIV July–Sept, 1977.
13. Bermudez N, Camacho E, Cervantes S, et al: Informe sobre condiciones ambientales y su relación con el estado nutricional de los niños. Encuesta Nacional de Nutrición, 1978. Bol Inf SIN (Costa Rica) 1:4–10, 1980.
14. Jackson RL, Kelly G: Growth charts for use in pediatric practice. J Pediatr 27:215–229, 1945.
15. Ministerio de Salud Pública y Asistencia Social. Instituto de Nutrición de Centro América y Panamá: "Clasificación Funcional de Problemas Nutricionales en El Salvador." Reporte final. Guatemala: INCAP, 1977.
16. Arroyave G: Unpublished data.
17. Flores M: Unpublished data.
18. Valverde V, Nieves I, Sloan N, et al: Styles of life and nutritional status of children from different ecological regions of El Salvador. Ecol Food Nutr 9:167–177, 1980.
19. Roig J: Estudio de la historia nutricional en Costa Rica mediante el indicador talla/edad. Bol Inf SIN (Costa Rica) 1:6–11, 1980.
20. Valverde V, Martorell R, Mejía-Pivaral V, et al: Relationship between family land availability and nutritional status. Ecol Food Nutr 6:1–7, 1977.
21. Vinocur P: Clasificación funcional de poblaciones desnutridas en Costa Rica. Segunda parte. Metodología desarrollada. Bol Inf SIN (Costa Rica) 1:10–14, 1980.
22. Secretaria General del Consejo Nacional de Planificación Economica. Instituto de Nutrición de Centro América y Panamá. "Informe Preliminar del Proyecto Regionalización de la Problemática Nutricional en Guatemala y sus Posibles Soluciones." Guatemala: INCAP, 1980.
23. Viteri F, Alvarez E, Pineda O: Prevention of iron deficiency by means of iron fortification of sugar. In Underwood B (ed): "Nutrition Interventions." Cambridge: MIT Press (in press).
24. Kielman A, McCord C: Weight for age as an index of risk of death in children. Lancet 1:1247–1250, 1978.
25. Chen L, Alaudden Chowdhury AK, Huffman SL: Anthropometric assessment of energy-protein malnutrition and subsequent risk of mortality among preschool aged children. Am J Clin Nutr 33:1836–1845, 1980.
26. Costa Rica Ministry of Health: "Encuesta Nacional de Nutrición. Evaluación dietética año 1978." San Jose, Costa Rica: Ministerio de Salud, Departamento de Nutrición, 1979.