

Endemic Goiter in Costa Rican School Children

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The present report from Costa Rica is the last of the series from the member countries of INCAP. It contains references to previous studies, together with further emphasis on the public health importance of adopting prophylactic measures for the control of endemic goiter.

✳ As a result of efforts made by the World Health Organization and its Regional Office for the Americas, the Pan American Sanitary Bureau, special attention has been given to endemic goiter as a health problem in Latin America. In recent years the public health departments of each one of the six countries of Central America and Panama, in cooperation with the Institute of Nutrition of Central America and Panama (INCAP), have conducted surveys to evaluate the importance of endemic goiter in their populations. Reports have been published for El Salvador,¹ Guatemala,² Honduras,³ Nicaragua,⁴ and Panama.^{5, 6}

These studies have all revealed a relatively high incidence of endemic goiter and have stimulated legislation requiring the compulsory iodization of salt. Laws to this effect have been enacted in Guatemala and Panama and are pending in the other countries. Endemic goiter has been known to exist in Costa Rica for years, although its extent and severity have not previously been determined. Early in 1941 a law requiring the iodization of salt was

passed, but to date it has not been enforced.

The present report summarizes the results obtained in the survey of 26,768 school children in all sections of Costa Rica conducted during the years 1952 through 1955.

Materials and Methods

Localities were randomly selected to include the entire country and to represent both the rural and the urban areas in each one of the provinces. According to the census of 1950, the population of Costa Rica * was 800,875; of this total, nearly 232,978 (29.1 per cent) were between seven and 18 years of age. The sample studied was derived from this group.

One or more schools were visited in each locality depending on the size and the homogeneity of its population and the children attending these schools examined. The sample studied represented approximately 11.5 per cent of the total population between seven and 18 years of age.

* The Republic of Costa Rica, with 51,011 square kilometers, is the second smallest in extent among the countries of Central America and Panama. A cordillera runs through the central part of the country. These highlands have an altitude of approximately 3,000 feet and are densely populated. The rest of the country is low in altitude and is thinly populated. The republic is divided into seven provinces.

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After careful inspection and palpation of the thyroid gland, persons were classified in the following four groups, based on the recommendations made by the Third Conference on Nutrition Problems in Latin America⁷: (0) Persons without goiter—thyroid gland not larger than four to five times the normal volume; (1) persons with palpable goiter—thyroid gland larger than four to five times the normal volume, but not large enough to be classified in Group 2; (2) persons with visible goiter—markedly enlarged thyroid readily visible with the head in semiextended position; and (3) persons with large goiter—greatly enlarged glands readily visible at a distance.

The normal outline of a lateral lobe was considered to be approximately that of the thumbnail of the person being examined. The presence of nodules was recorded and when they were present the goiter was classified as adenomatous.

Results

The distribution of goiter according to sex and age is shown in Table 1. In both age groups the incidence of goiter was slightly higher in females than in males. The incidence of goiter tended to increase with age, as is clearly reflected by the difference in the incidence reported for the two age groups. Nearly

Table 1—Endemic Goiter in Costa Rica According to Sex and Age

Sex	Age in Years	No. Examined	Type of Goiter		Incidence Per cent
			Dif-fuse	Adeno-matous	
Female	7-12	10,057	1,200	126	13.2
	13-18	1,503	331	26	23.8
Male	7-12	13,002	1,236	120	10.4
	13-18	2,206	396	31	19.4

Table 2—Geographic Distribution of Endemic Goiter in Costa Rican Children

Province	Population Between 7-18 Years of Age	Incidence of Endemic Goiter Per cent
San José	79,600	12.0
Cartago	30,904	11.9
Heredia	14,955	15.2
Guanacaste	28,309	25.6
Puntarenas	23,838	20.3
Limón	10,279	10.2
Alajuela	45,093	20.4
Over-all total	232,978	16.5 *

* Average weighted for age distribution and proportionate number of persons per province.

all of the goiters recorded were size 1 and very few nodular or adenomatous goiters were found.

The geographic distribution of goiter is shown in Table 2. In all seven provinces the incidence of endemic goiter was over 10 per cent. The highest incidence was found in the province of Guanacaste with 25.6 per cent and the lowest in Limón with 10.2 per cent. At the completion of the survey both the incidence of goiter in a sample of school children of each age group in each province and the total number of school children in each group and province were known. However, the proportion of children examined varied from one province and age group to another and hence the precision of the estimate of the incidence in each province also varied. Taking into consideration these factors, the over-all incidence for the country was calculated to be 16.5 per cent.*

The incidence of goiter corrected for age distribution was found to be 18.4 per cent in 4,797 children in rural

* The procedure followed was that suggested by Cochran⁸ and is an example of ratio estimates in stratified random sampling where the provinces form the strata.

localities and 11.4 per cent for 21,971 in urban areas. There was no suggestion of racial difference in the incidence of goiter in the survey findings.

Discussion

The increased incidence of goiter in adolescence should not be interpreted as a normal physiologic phenomenon, since goiter does not ordinarily occur in these persons when the iodine intake is adequate. In the present study the highest incidence of goiter (28.6 per cent) was encountered in 15-year-old girls. An increase in the physiologic demand for iodine in adolescence is probably the chief factor accounting for a corresponding increase in the frequency of goiter, from a low of 6 per cent at seven years of age to one of 18–20 per cent at 13 years. It is obvious that a study based largely on young school children results in a low estimate of the incidence of endemic goiter in the entire population of the country.

Nodular goiters were rarely encountered in this study. In relatively young persons in populations in which the incidence of goiter is only moderately high, diffuse goiter is much more frequently encountered than the nodular type.^{1, 3} However, the surveys in Central America have encountered a higher incidence of adenomatous goiter in older age groups where adenomas have had an opportunity to increase in size, particularly in areas where the total incidence of goiter is high.²

It is difficult to identify the factors responsible for the higher incidence of goiter in rural areas as compared with the urban ones. However, certain possible goitrogenic factors such as vitamin A deficiency^{9, 10} may be involved. Furthermore, diets of persons living in rural areas are generally more monotonous and have a higher proportion of locally grown foods. This reduces the amount of iodine obtained by the rural

population through the consumption of foods from nongoitrous areas which are richer in this compound.

It has been suggested that endemic goiter should be considered a serious public health problem when the incidence in a population is revealed by surveys to be above 10 per cent.^{7, 11} When this is shown to be the case the iodization of salt for human consumption should be adopted as a prophylactic measure. Since the over-all weighted incidence of endemic goiter in Costa Rica has been found to be over 16.5 per cent in school children, there is no doubt that endemic goiter is an important public health problem.

Analysis of four different samples of salt obtained from Costa Rica has revealed values for their iodine content of approximately 0.04 mg per 10 gm of salt.¹² This corresponds to approximately 1 part of iodine in 250,000 parts of salt, a level very much lower than that of 1 in 10,000 to 1 in 20,000 suggested by the Third Conference on Nutrition Problems in Latin America.⁷ On the basis of daily per capita consumption of salt of 10 gm,¹³ persons in Costa Rica are receiving in salt only 10 per cent of the amount of iodine recommended.⁷

Whether or not goitrogenic factors are prevalent in Costa Rican environment, it has been definitely shown that the oral administration of iodine, either in the form of potassium iodate or iodide, reduces the incidence of endemic goiter under the conditions prevailing in Central America.¹⁴ Consequently, it is important to stimulate the enforcement of the law approved in 1941 which requires the compulsory iodization of common salt. Since the frequency of goiter was found to be higher than 10 per cent in six out of the seven provinces, it is clear that this measure should apply to all of the salt in the country destined for human consumption.

The use of potassium iodate is recommended in many tropical areas for iodization because of its stability under extremes of moisture and temperature.^{7, 11} Since the potassium iodide can be used only to iodize a very dry refined salt distributed in a protected package, potassium iodate will prove more practical for the iodization of salt in Costa Rica.

On the basis of present knowledge of physiologic requirements for iodine, the possible presence of goitrogenic factors and the amounts of iodine already present in most Latin American diets in goitrous areas, the Third Conference on Nutrition Problems in Latin America recommended that the maximum and minimum levels of iodization be 1 part of iodine in 10,000 parts of salt and 1 part in 20,000, respectively.⁷ It is suggested that the salt in Costa Rica be iodized in this range.

Summary

A total of 26,768 children were examined in both rural and urban areas of the seven provinces of Costa Rica. The per cent of goiter increased from 11.6 per cent in the seven- to 12-year age group to 21.1 per cent at ages 13 to 18. Females had a consistently higher incidence, but the differences were not statistically significant. The frequency was higher in rural than in urban areas. The lowest incidence in any province was 10.2 per cent and the highest 25.6 per cent. The remaining provinces had averages between 12 and 20 per cent. Goiter with palpable adenomas constituted only 0.8 per cent of the total.

The over-all weighted percentage for the school-age population in the entire country was 16.5 per cent. The error in the estimates of such a figure was not likely to be above 20 per cent. It is concluded that the law requiring the iodization of salt should be enforced. The addition of potassium iodate to salt at a level between 1 part of iodine in 10,000 parts of salt and 1 part in 20,000 is recommended.

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