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**cassava toxicity
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**proceedings of
a workshop
held in**
Ottawa, Canada,
31 May – 2 June 1982

Editors: F. Delange and R. Ahluwalia

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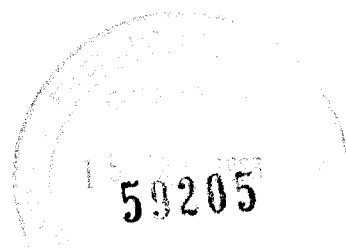
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CASSAVA TOXICITY AND THYROID:

RESEARCH AND PUBLIC HEALTH ISSUES



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CASSAVA TOXICITY AND THYROID:

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**Proceedings of a workshop held in
Ottawa, Canada, 31 May – 2 June 1982**

Editors: F. Delange¹ and R. Ahluwalia²

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Résumé

Cette publication est un résumé des actes d'un atelier qui a porté sur les relations entre la consommation de manioc et les troubles thyroïdiens chez l'homme. L'atelier a rassemblé des spécialistes de la médecine, de l'agriculture et de l'hygiène publique pour (1) examiner les résultats des études subventionnées par le CRDI sur le rôle du manioc dans l'étiologie du goitre endémique et du crétinisme ; (2) passer en revue les travaux de recherche sur les aspects du manioc intéressant l'agriculture ; (3) échanger des informations sur la méthodologie et les résultats d'études dans des domaines connexes ; et (4) définir les priorités de recherche et faire des recommandations touchant les programmes d'hygiène publique. La poursuite des travaux de recherche dans ces domaines contribuera grandement à prévenir et à contrôler le goitre endémique qui, par les anomalies de développement dont il est la cause constitue toujours un grand danger pour les populations des pays en développement.

Resumen

Esta publicación informa sobre las exposiciones presentadas en un seminario dedicado a la relación entre el consumo de yuca y el problema de la tiroides en los humanos. El seminario reunió científicos de los sectores médico, agrícola y de salud pública con el objeto de (1) reseñar los resultados de los estudios financiados por el CIID sobre el papel de la yuca en la etiología del bocio endémico y el cretinismo, (2) reseñar las actividades investigativas sobre aspectos agrícolas de la yuca, (3) intercambiar información sobre metodologías y hallazgos de otros estudios relacionados, y (4) identificar prioridades específicas para la investigación y hacer recomendaciones para los programas de salud pública. Los esfuerzos continuos en estas áreas de la investigación se dezicarán en buena parte a prevenir y controlar el bocio endémico y sus anormalidades acompañantes en el desarrollo, las cuales siguen constituyendo un problema serio de salud pública entre las poblaciones del mundo en desarrollo.

Contents

Foreword 7

Cassava and Endemic Goitre

Role of Cassava in the Etiology of Endemic Goitre and Cretinism
*A.M. Ermans, P. Bourdoux, J. Kinthaert, R. Lagasse, K. Luvivila,
 M. Mafuta, C.H. Thilly, and F. Delange* 9

Nutritional Factors Involved in the Goitrogenic Action of Cassava
*F. Delange, P. Bourdoux, E. Colinet, P. Courtois, P. Hennart, R. Lagasse,
 M. Mafuta, P. Seghers, C. Thilly, J. Vanderpas, Y. Yunga, and
 A.M. Ermans* 17

Role of Other Naturally Occurring Goitrogens in the Etiology of Endemic
 Goitre *Eduardo Gaitan* 27

Discussion: Cassava and Endemic Goitre 35

Public Health and Nutritional Aspects of Endemic Goitre and Cretinism

Public Health and Nutritional Aspects of Endemic Goitre and Cretinism in
 Asia *N. Kochupillai and V. Ramalingaswami* 43

Public Health and Nutritional Aspects of Endemic Goitre and Cretinism in
 Africa *M. Benmiloud, H. Bachtarzi, and M.L. Chaouki* 49

Nutritional and Public Health Considerations Relating to Endemic Goitre
 and Cretinism in South America *José R. Varea Terán* 55

Public Health and Nutritional Aspects of Endemic Goitre in Nepal —
 Summary *K.B. Singh* 62

Endemic Goitre in the State of Sarawak, Malaysia *Tan Yaw Kwang* 64

Cassava Consumption, Endemic Goitre, and Malnutrition in Costa Rica
Leonardo Mata, Emilce Ulate, Sandra Jiménez, and Carlos Díaz 69

Endemic Cretinism in the Andean Region: New Methodological Approaches
Ignacio Ramirez, Marcelo Cruz, and José Varea 73

Cassava Diet, Tropical Calcifying Pancreatitis, and Pancreatic Diabetes
P.J. Geevarghese 77

*Discussion: Public Health and Nutritional Aspects of Endemic Goitre and
 Cretinism* 79

Overview of Production and Utilization of Cassava

An Overview of Cassava Consumption and Production *Truman P.
 Phillips* 83

Utilization of Cassava in the European Community	<i>D. Renshaw</i>	89
Agricultural Research on Cassava		
Cassava Research to Overcome the Constraints to Production and Use in Africa	<i>S.K. Hahn</i>	93
Agricultural Research on Cassava in Asia and Australia	<i>Gerard H. de Bruijn</i>	103
Discussion: Overview of Production and Utilization of Cassava and Agricultural Research on Cassava		108
Animal and Genetic Research Trends in Cassava		
Cassava, Cyanide, and Animal Nutrition	<i>Guillermo Gomez</i>	109
Thyroid Cassava Toxicity in Animals	<i>Olumide O. Tewe</i>	114
Toward Lower Levels of Cyanogenesis in Cassava	<i>Gerard H. de Bruijn</i>	119
Discussion: Animal and Genetic Research Trends in Cassava		123
Cassava Processing and Nutrition Education		
Processing and Detoxification of Cassava	<i>O.L. Oke</i>	129
Traditional Cassava Detoxification Processes and Nutrition Education in Zaire	<i>P. Bourdoux, P. Seghers, M. Mafuta, J. Vanderpas, M. Vanderpas-Rivera, F. Delange, and A.M. Ermans</i>	134
Effects of Cassava Processing on Residual Cyanide	<i>Rodney D. Cooke</i>	138
Discussion: Cassava Processing and Nutrition Education		143
Conclusions and Recommendations		
		145
Participants		
		147

Cassava Consumption, Endemic Goitre, and Malnutrition in Costa Rica

Leonardo Mata,¹ Emilce Ulate,¹ Sandra Jiménez,¹ and Carlos Díaz²

Consumption of Cassava (Yuca)

More than 100 varieties of *Manihot esculenta* are grown in Costa Rica, a few of which are native. Three cultivars are popular: manggie, valencia, and guacimo, the latter being a bitter local variety. At present, sweet cultivars mex-59 and cmc-76 are being promoted because of their low cyanide content. In 1980 and 1981, national cassava production reached 17 000–18 000 metric tons for a population of 2.2 million.

Cassava is eaten by many Costa Ricans. Data on cassava consumption were obtained from the 1978 national nutrition survey (Díaz et al. 1978) and a field study of health and growth in Puriscal (Mata et al. 1981). Cassava is prepared in many different ways and is always well cooked. It is never, to the best of our knowledge, eaten raw. At least eight different ways of preparing cassava were observed in a survey of 30 families in Puriscal (Table 1). Boiled, alone or

with other vegetables; eaten with salt; or eaten with other species are preferred. Cassava leaves are not consumed. Raw cassava is used in animal feed. Only 17% of the families in Costa Rica consume cassava according to the 1978 national nutrition survey (Table 2). People in sparsely populated rural areas consumed the least cassava, probably due to its low availability when not produced locally.

Mean cassava consumption is rather low (Table 3) and contributes little to the total calorie and protein content of the diet, in contrast with observations in Africa (Ermans et al. 1980; Delange et al. 1982). Only 13% of children consume cassava, the intake being greater in urban areas than in rural areas (Table 4). Daily consumption of cassava among lactating women and neonates was found to be low (Table 5). A considerable proportion of the members in cassava-consuming families do not consume cassava on a regular basis. It was observed that 67% of family members consumed cassava every week and less than 1% consumed it daily.

Table 1. Cassava consumption, 30 families of Puriscal, Costa Rica, 1982.

Form of preparation	Frequency (%)
Boiled	21(70)
Soup with vegetables	19(63)
Fried cakes	16(53)
Boiled-fried	14(47)
Soup with meat and vegetables	13(43)
Boiled with melazza	10(33)
Puree	2(7)
Boiled-fried stuffed with cheese or meat	1(3)

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Prevalence of Malnutrition and Goitre

The national nutrition survey of 1966 (INCAP-OIR 1969) revealed that a considerable number

Table 2. Frequency of cassava consumption, 253 families, Costa Rica, 1978.

Population	Number of families	Number (%) of families consuming cassava
Urban	91	17(18.6)
Rural dense	84	18(21.4)
Rural sparse	78	9(11.5)
National mean	253	44(17.3)

Table 3. Mean consumption of cassava in Costa Rica, 1978.

Population	Grams		Calories		Protein	
	Per family	Per capita	Total	% ^a	Grams	% ^a
Urban	402.8	67.2	89	4.6	0.7	1
Rural dense	622.6	98.8	130	6.3	1.0	1
Rural sparse	577.0	117.1	155	7.9	1.2	1
National mean	534.1	94.3				

^aPercentage of total nutrient value of diet.

Table 4. Cassava consumption (frequency and amount) by children 1-6 years old, Costa Rica, 1978.

Population	Number of children	Number (%) of children consuming cassava	Grams per capita	Calories		Protein	
				Total	% ^a	Grams	% ^a
Urban	75	13(17.3)	62.6	83	5.7	0.6	1.2
Rural dense	82	10(12.1)	38.3	51	3.9	0.4	1.0
Rural sparse	71	6(8.4)	62.6	83	5.8	0.6	1.3
National mean	228	29(12.7)	54.4				

^aPercentage of total nutrient value of diet.

Table 5. Daily consumption of cassava among lactating women and neonates, Puriscal, 1980.

Month of lactation	Months of age (neonates)	Number of persons	Number of persons (%) consuming cassava	Consumption of cassava in grams	
				Mean $\pm$ SD	Minimum-Maximum
1		40	9(22)	64.6 $\pm$ 25.3	34-123
3		29	6(21)	76.4 $\pm$ 22.4	50-104
5		29	12(41)	84.9 $\pm$ 31.4	30-120
7		23	9(39)	76.4 $\pm$ 28.4	31-120
9		13	4(31)	92.2 $\pm$ 31.8	56-120
	0-3	261	0		
	4-11	271	16(6)	32.0 $\pm$ 27.2	

of infants and preschool children were deficient in weight and height for their age (Table 6). Goitre was prevalent, especially among women (Table 7).

In retrospect, the health profile of Costa Rica shows a marked and constant improvement after 1940, based upon falling rates of infant mortality and death due to diarrheal diseases, and by a dramatic increase in life expectancy at birth (Mata and Mohs 1978; Villegas and Osuna 1979; Mohs 1980; Mata 1981). Other health parameters also reveal improvement. For instance, there have been no cases of polio or death due to diphtheria during the last 8 years; the morbidity and mortality due to measles, whooping cough, and tuberculosis have decreased sharply; and a dramatic decline in energy-protein malnutrition and endemic goitre has been recorded (Tables 6, 7). Collaterally, hypothyroidism has also decreased

during the last few years.

As expected from the prevalence of malnutrition and goitre, cretinism is not now a serious problem in Costa Rica. About half a dozen new cases are diagnosed each year at the National Children's Hospital, in contrast with the dozens of cases diagnosed annually before the iodination of salt began in 1974.

Comment

The decrease in malnutrition has been attributed to an overall improvement in the quality of life, especially through education, hygiene, and income (Mata and Mohs 1978). With regard to malnutrition, the most feasible explanation for the secular trends recorded during the last 16 years is the drastic reduction in acute infections, especially diarrhea and common communicable diseases such as measles and

Table 6. Evolution of the nutritional status of Costa Rican children 0-4 years old, 1966-1978.

Survey year	Number of children	Percentage stunted (<90% height/age)	Percentage wasted (<76% weight/age)	Reference
1966	791	16.9	14.2	INCAP-OIR (1969)
1975	1910	7.2	12.1	Díaz et al. (1975)
1978	2646	7.6	7.8	Díaz et al. (1978)

Table 7. Prevalence of endemic goitre in Costa Rica, 1952-1979.

Survey period	Age of population (years)	Number of persons	Percentage prevalence	Reference
1952-1955	7-18	10% of schoolchildren	18.4	Pérez et al. (1956)
1966	All ages	3735	18.0	INCAP-OIR (1969)
1975-1978	All ages	2012	11.9	INISA (unpublished data)
1975-1978	0-9	529	6.6	INISA (unpublished data)
1979	5-15	4883	3.6	Flores et al. (1981)

whooping cough. No striking changes in diet were noted, although there has been a trend toward a higher intake of animal protein (Díaz et al. 1975, 1978). Cassava does not contribute much to the nutrient value of the diet, and the present low level of consumption does not seem to increase the risk of goitre, cretinism, malnutrition, or other maladies associated with it.

The decline in goitre has been attributed to a government-supported salt iodation program, initiated in 1974. There is evidence that iodation of salt was not carried out properly in Costa Rica. For instance, monitoring of the iodine content in salt samples selected at random revealed suboptimal levels of iodine in most of them. However, iodine was detected in most of the samples, enough to induce a response in susceptible persons, as judged by an epidemic of hyperthyroidism (Jod Basedow phenomenon) (Quesada et al. 1976), and by improved iodine uptake (Estrada et al. 1975). Other contributory factors to the decline in goitre should be considered. Better methods of communication in the goitrogenic highland zones improved availability of foods from the lowlands and oceans. A decrease in the intake of cassava and other goitrogenic foods seems to have occurred, judging by the current low levels of consumption. One factor to consider is the increase in chlorinated piped water that, at present, serves almost 100% of the urban and about 70% of the rural populations of Costa Rica. The improvement in water supply began during the 1960s and has been responsible, in part, for the reduc-

tion of death due to diarrheal disease from about 100 per 100 000 inhabitants during the early 1960s to 4.5 in 1981 (Mata 1981). Water contaminated with certain bacteria seems to be a factor favouring goitre (Gaitán et al. 1978).

Goitre is still observed in certain families. The importance of studying the epidemiology of goitre in these families cannot be denied. The study should determine if cassava consumption is high in such families, and which cultivars of cassava and forms of preparation are used. The presence of other goitrogenic factors in food, and particularly in drinking water, must also be investigated.

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