

## FEATURE

*A monthly features service on scientific, technical, and educational subjects pertinent to development.*

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CASSAVA: SOLVING THE  
TOXICITY PROBLEM

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The root crop cassava is the major source of carbohydrates for some 300 million people in tropical regions. With a total production of about 100 million tons, it is the world's seventh most important crop, after the principal cereal grains, potatoes and sweet potatoes. Production is constantly increasing, and is expected to double in 30 years or so.

This background underlines the importance of the findings reported by a team of Belgian physicians, who have demonstrated after several years of research that under certain circumstances the consumption of cassava can provoke goiter, cretinism, and mental retardation.

The survey that led to this finding started nearly 10 years ago on Idjwi Island, situated in Lake Kivu, Zaire, and inhabited by some 30,000 people scattered throughout 69 villages.

It showed that there was a severe and uniform shortage of iodine throughout the island. So the researchers were surprised by their first, then unexplained, finding: in certain villages, particularly in the south, there were hardly any cases of goiter; in others, mostly in the northern part of the island, the condition was endemic, with more than half the population affected.

A team of researchers from the Saint Pierre Hospital, Brussels, working with Zairian physicians from the Zaire Scientific Research Institute, set out to solve this mystery. A first study of iodine uptake by the thyroid gland and of iodine excretion in urine was

carried out on more than 600 men, women, and children in different villages. The results showed there was no significant differences between endemic areas, and goiter-free ones.

Another survey, based on geological data, was undertaken. It was known that the soil in the endemic areas was of a different composition than the soil in goiter-free areas, and the researchers speculated that these differences might be reflected in the composition of plants grown and eaten by the islanders. This lead, however, also turned out to be disappointing: the soil composition had no detectable effect on goiter.

The researchers then undertook a detailed study of food crops grown on the island: bananas, sweet potatoes, groundnuts, cassava, pumpkins... The goal here was to find out whether the ingestion of one plant or another could affect iodine uptake by the thyroid.

It was then that cassava appeared as the number-one suspect. People whose diet included large amounts of cassava were found to absorb via the thyroid gland an amount of iodine well under the normal. Analyses of urine and serum samples also revealed that the islanders who regularly ate cassava had a high level of thiocyanate, an anti-thyroid substance associated with the consumption of certain vegetables.

The prime function of the thyroid gland is to secrete hormones that regulate tissue oxydation processes. Iodine is an essential constituent of these hormones. Thyroid activity is thus dependent on the amount of iodine in our food. Normally, the absorption of 100 micrograms of iodine a day is sufficient to ensure adequate thyroid function.

If there is a shortage of iodine, or if iodine uptake is inhibited, the thyroid gland is stimulated by a regulatory process in which a pituitary hormone secreted by a gland located at the base of the brain plays a key role. It is the thyroid stimulating hormone (TSH) that "instructs" the thyroid to resume normal function but, in the absence of iodine, provokes an increase in volume of the thyroid, that is, a goiter. This overgrowth does not necessarily represent a

sufficient adaptation to prevent thyroid hormone shortage. The patient suffers from thyroid insufficiency; he lacks hormones to regulate certain metabolic processes, notably those that concern the central nervous system. When this insufficiency occurs during the first months of life it can disturb the maturation and development of the nervous system. In the worst cases the result is extreme mental retardation and impairment of psychomotor development.

If iodine shortage occurs only after the first month of life, the thyroid may have accumulated sufficient iodine to function almost normally. There are no signs of thyroid insufficiency, but it is possible nevertheless that mental development is retarded.

It is impossible to evaluate the incidence of the less severe forms of mental retardation; these could lower the level of intelligence of an individual, and, on the scale of an entire population, become a major obstacle to development. In the past ten years or so, epidemiological studies in rural regions of Africa, South America and Asia, have revealed that endemic goiter is much more widespread than had been believed. It is estimated today that some 200 million people throughout the world are affected by this disease to varying degrees.

What can be done to prevent these diseases?

It is known that mental retardation and other sequels of congenital hypothyroidism can be avoided if iodine treatment is started during the first days of life. However, it is almost impossible to make the diagnosis of thyroid insufficiency at birth on the basis of clinical signs.

Dr. François Delange, together with Dr. Claude Thilly, another member of the Belgian team, recently perfected a technique that determines the level of the pituitary hormone TSH from a single drop of dried blood. The level of this hormone increases when thyroid function is insufficient and the test thus allows the diagnosis of thyroid insufficiency in newborn infants.

A vast campaign is now being undertaken to eradicate goiter and cretinism in the Ubangui region in north-eastern Zaire where goiter is endemic. Treatment consists of intramuscular injections of iodine in an oily solution that diffuses the iodine throughout the organism, over a period of three to seven years. Some 300,000 injections have already been given, and 700,000 more are scheduled. This long-term project is supported by the Belgian General Administration of Cooperation and Development, the Ministry of Science Policy, and the Medical Fund for Scientific Research.

The Canadian-based, International Development Research Centre, which has supported research into cassava toxicity in the region since 1974, is now funding a second phase of this research. The aim is to define precisely the nutritional conditions required in man to induce goiter and cretinism, and to study the mechanism responsible for mental retardation resulting from a cassava-based diet.

The potential impact of these findings and of the diagnosis and treatment campaigns is evident. At stake are not only the health of vast populations, but the intellectual capabilities of men and women carrying the heavy burden of endemic mental retardation, as they strive to overcome the difficult conditions of their lives.

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