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Simple solution fights konzo

A basic wetting process can cut the cyanide content of cassava flour, reducing the risk of debilitating paralysis. Howard Bradbury explains

KONZO is a terrible condition affecting particularly children, and women of childbearing age. The result of cyanogens poisoning, caused by eating cassava – a staple crop in tropical Africa – it causes irreversible paralysis of the legs. The real tragedy: konzo is probably avoidable, as long as the cassava flour is treated properly.

Konzo is an upper motor neuron disease that happens very suddenly and occurs in Eastern, Southern and Central Africa (see Figure 1). There are several thousand cases in Mozambique and also in Tanzania and many thousands of cases in the Democratic Republic of Congo (DRC), formerly Zaïre. Konzo also affects people in Cameroon, Central African Republic and probably other tropical African countries. Konzo epidemics occur as a result of war, such as the recent civil war in DRC, where normal life is disrupted and rural people are forced to live off the land and may consume bitter cassava roots from the bush. Outbreaks of konzo also occur as a result of drought, because the cassava plant makes much more cyanogen under water stress than under normal conditions. Working in Mozambique in collaboration with Julie Cliff, Paula Cardoso, Mario Ernesto, Domingos Nicala and others, we found that konzo persists across the years in certain locations in Nampula Province. While it is often possible to rehabilitate people with konzo, this involves physiotherapy, good nutrition and provision of crutches (see Figure 2).

Cyanogens from cassava can also cause various other medical conditions. Firstly, they can cause acute intoxication, the symptoms of which are headache, dizziness, stomach pain, diarrhoea and vomiting and in extreme cases death due to cyanide poisoning.

Because the lethal dose of cyanide is proportional to body weight, children are more susceptible to cyanide poisoning than adults. Secondly, in some provinces of DRC there is a deficiency of iodine in the diet which causes goitre and cretinism and this is made worse by ingestion of cyanogens from cassava. Thirdly, in West Africa there is a disease called tropical ataxic neuropathy (TAN), which occurs amongst older, generally poor people who have consumed a monotonous cassava diet for many years. TAN is progressive and causes unsteady walking, produces loss of sensation in the feet and hands, loss of vision, deafness and weakness. On top of this, excessive levels of cyanogens from cassava have been blamed for stunting the growth of children in DRC. Stunting probably results from reduced protein synthesis, as a result of the body using its essential S-containing amino acids to detoxify poisonous cyanide and produce soluble thiocyanate that is removed in the urine.

Cassava

Cassava is the third most important food source in the tropics after rice and maize and is the staple food of up to one billion people. The average daily per capita consumption of cassava in 2005 in the 14 highest consuming African countries was at least twice that of major world producers Indonesia, and three times that of Brazil. This illustrates how strongly many African countries rely on cassava. Cassava production in tropical Africa has also increased greatly, in line with its rapidly-increasing population. Cassava produces good yields, even in poor soil without fertiliser, and is drought tolerant. The plant has bulbous edible roots which are very starchy, and the young leaves are used in Africa as a good source of protein and vitamins (see Figure 3).

Of the more than 2000 different plants that use poisonous cyanide to deter predators, cassava is the most important food plant by far. The plant contains the cyanogenic glucoside linamarin and a small amount of lotaustralin (methyl linamarin). They are located inside the plant cell. When the cell is ruptured by a predator, the enzyme linamarase, located in the cell wall, catalyses the hydrolysis of linamarin to produce glucose and acetone cyanohydrin. The latter breaks down spontaneously above pH 5 to give acetone and poisonous hydrogen cyanide gas, which deters the predator.

Linamarin is present in large amounts in the leaves and the peel of the roots. Depending on the variety of cassava and environmental factors, the inner part of the root, also known as parenchyma, contains varying concentrations of bitter-tasting linamarin. The sweet cassava common to the South Pacific only contains a small amount of linamarin, while some varieties in Africa record a much higher linamarin content. One very high cyanide variety in Nigeria is called "chop and die." Analyses of many thousands of varieties show that the total cyanide content of the parenchyma can range from 1–1550 mg ICN equivalents/kg fresh root (equivalent to 1–1550 ppm).

Processing

Peeled sweet cassava roots may be boiled and eaten, as is common in the South Pacific, but roots containing 100 ppm total cyanide or more must be processed.

One processing method is sun drying, which removes around 70% of the original root cyanide. It involves drying the peeled roots in the sun, after which they are ground in a wooden mortar and
field-tested in two locations in the Nampula and Zambézia provinces of Mozambique in 2005, using the following procedure: Rural women fill a bowl with flour and make a mark on the inside of the bowl. They then add water and mix it until the wet flour comes up to the mark. The wet flour is then spread in a thin layer not more than 1 cm thick on a basket and left in the shade for five hours, to allow the HCN gas to escape. The women then mix the wet flour with boiling water, as is the custom, to produce a stiff porridge. A blind taste test using local volunteers with stiff porridge made from untreated and treated flour, showed that 60% preferred the stiff porridge made from treated flour – probably because the wetting process removed the bitterness of linamarine. The rural women readily accepted this extremely simple wetting method, which does not require additional equipment, use more water or cause additional work. Dulce Nhassico from the faculty of medicine at Eduardo Mondlane University in Maputo, Mozambique, in 2006 organised two workshops for nutritionists, health and NGO workers in Nampula City and Quelimane, Mozambique at which Cumbana explained the process and its benefits. A poster was prepared in Portuguese and this has subsequently been translated into English, French and various African languages to help explain the process to local women (Figure 4). Laminated posters are now available free of charge.

The Australian Agency for International Development (AusAID) is currently funding a one-year programme of konzo rehabilitation and prevention, and the wetting method is being introduced to rural women in konzo-prone communities in Nampula province of Mozambique. This programme involves Domingos Nicala, a physiotherapist in Mozambique and an expert in the treatment and rehabilitation of konzo patients, who together with the Mozambican Red Cross works with trained women interpreters to show the rural women how to use the wetting method. The Tanzanian Red Cross is hoping to start a similar programme in 2008, supported by AusAID, in the Mtwara and Ruaha regions of Southern Tanzania. These projects will serve as prototypes for further implementation of the wetting method in konzo-prone communities.

We hope that use of the wetting method will reduce the occurrence of acute intoxication and konzo especially during periods of drought.

Despite these efforts, we urgently need more funds to further publicise the wetting process. In particular, we desperately want to spread the word among women in DRC, where there are many thousands of cases of konzo cases due to the recent civil war. While we have plans for a potential project in DRC, it is currently unfunded and cannot be put into practice until some funding is made available.

If you or your company can help in any way, please contact the author, he would love to hear from you.

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