Innovation and success in prevention of konzo

By Dr Howard Bradbury

This article was prepared by Dr Howard Bradbury, who is an Emeritus Fellow at the Australian National University. Since the mid-nineties he has been dedicated to researching the effects of poisonous cyanogens in cassava and neurodegenerative diseases such as konzo and TAN that affect the poorer communities of the tropical world. He developed simple kits to measure total cyanide in cassava roots, flour and leaves and urinary thiocyanate, see http://biology.anu.edu.au/hosted_sites/CCDN/ He established the free Cassava Cyanide Diseases Network in June 2001 that became the Cassava Cyanide Diseases and Neurolathyrism Network in 2009 (see news piece in this edition). In collaboration with Professor J. P. Banea, Director of the National Institute of Nutrition (PRONANUT) in DRC, they have controlled konzo in 13 villages with a population of nearly 10,000 people in Kwango District, DRC.

The article reflects the work of the following team: J.H. Bradbury,(1) J.P.Banea,(2) C. Mandombi,(3) D, Nahimana,(2) I.C. Denton,(1) N. Kuwa(2)

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What we know: Konzo is an irreversible paralysis of the legs associated with consumption of high cyanide cassava flour in a protein deficient diet. Traditional methods to reduce cyanide levels in cassava flour are not effective. Traditional methods to remove cyanogens from cassava leaves lead to critical protein and vitamin losses.

What this article adds: The cyanide content of cassava flour is greatly reduced by a simple ‘wetting’ method. It has prevented new cases of konzo in 13 villages with a population of nearly 10,000 in Kwango District, Bandundu Province, DRC. A mild method (avoiding boiling) has been found to reduce the cyanide compounds from cassava leaves whilst preserving protein content and saving on fuel; this may be a useful alternative to current methods.

Prevention of konzo using the wetting method on cassava flour in the Democratic Republic of Congo (DRC)

Cassava flour, produced by traditional methods of either soaking (retting) peeled roots in water for some days or
else by sun drying, still contains unacceptably high amounts of cyanogens. The cyanide content of the flour is greatly reduced by using the wetting method as follows: Cassava flour is placed in a bowl and the level marked on the inside. Water is added with mixing; the level of the wet flour drops and then increases again until the level comes up to the mark. The wet flour is spread out on a mat in a thin layer and the enzyme present breaks down the cyanide compound producing hydrogen cyanide gas which escapes. Nearly complete removal of cyanogens takes about 2 hours in the sun or 5 hours in the shade.

Konzo is an irreversible paralysis of the legs that occurs mainly in children and young women after childbirth, associated with consumption of high cyanide cassava flour in a protein deficient diet. Kay Kalenge village in Popokabaka Health Zone had 34 cases of konzo. The women were shown how to use the wetting method and used it on their flour. Monthly visits were made to the village to check for new cases of konzo and every four months urine samples from school children were analysed for thiocyanate (which gave a good measure of cyanide intake) and cassava flour samples for cyanide content. No new cases of konzo occurred in Kay Kalenge during the 18 month intervention; the cyanide content of flour fell to less than 10 ppm and urinary thiocyanate levels dropped sharply.

We returned to Kay Kalenge 14 months after the intervention ceased and found that there were no new cases of konzo, the women still used the wetting method, the flour cyanide and urinary thiocyanate levels were low and the wetting method had spread by word of mouth to three nearby villages. The wetting method is simple, needs only a basin and mat and produces tasty high quality fufu. But most of all it guarantees food safety, prevents food poisoning and konzo.

We have made two more successful interventions to prevent konzo in six villages in Boko Health Zone. Currently, we are preventing konzo in six more villages in Boko Health Zone by teaching the wetting method to women who have accepted it gladly. This work, which has prevented new cases of konzo in 13 villages with a population of nearly 10,000 in Kwango District, Bandundu Province, DRC, has been funded by the Australian Agency for International Development (AusAID).

**Removal of poisonous cyanide compounds from cassava leaves at ambient temperature**

Cassava leaves are used particularly by the Congolese population of central Africa and in Liberia, Sierra Leone and Guinea and there is moderate use in other tropical African countries. The traditional method of removing cyanogens from cassava leaves is by pounding in a pestle and mortar followed by boiling in water for about 30 minutes. On boiling, the bright green colour of the leaves becomes dull green and there is considerable loss of vitamins and protein, including S-containing amino acids present in the protein in the leaves. The S-containing amino acids (methionine and cysteine/cystine) are needed for detoxification in the body of poisonous cyanide (CN) which is converted to thiocyanate (SCN) and is removed in the urine.

The importance of animal protein in preventing the occurrence of konzo was shown in three independent konzo outbreaks in Mozambique, Tanzania and the DRC. People of the same ethnic group as those who got konzo, who lived only 5 km away, did not get konzo because in Mozambique they had fish from the sea, in Tanzania they had fish from Lake Victoria and in the DRC they had animal protein from the forest. Thus konzo can be prevented by reduced cyanide intake and/or adequate nutrition, in particular, an adequate supply of S-containing amino acids needed to detoxify ingested cyanide.

We have now found that cyanogens are virtually completely removed from cassava leaves by following three simple steps as follows: (1) pounding, (2) standing for 2 hours in the sun or 5 hours in the shade and (3) washing three times in water. Using four different cassava cultivars, we found that the mean residual total cyanide content after steps 1, 2 and 3 were 28%, 12% and 1% respectively. The pounded, washed leaves which are free of cyanogens retain their bright green colour and texture. It is hoped that this mild method of removing
cyanogens from cassava leaves, may be a useful alternative to boiling pounded leaves in water, which would save on fuel for cooking and much more importantly, would improve the nutritional status of the cassava eating population of tropical Africa.

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