Working together to eliminate cyanide poisoning, konzo and tropical ataxic neuropathy (TAN).

CCDN News

Cassava Cyanide Diseases Network

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Utilization of cassava leaf as a food / feed supplement

Cassava leaves are a good source of protein, minerals and vitamins.[1] The leaves constitute a major component of the diet in countries such as Democratic Republic of Congo, Congo, Tanzania, Sierra Leone and Guinea. The proximate composition of cassava leaf compares favourably with the composition of other foods such as soybean, maize grain and amaranth leaves. Cassava leaf contains minerals particularly Ca, Fe, carotenoids and vitamins B and C. The leaves contain 7 – 10% protein on fresh weight basis.[2]

Plant proteins are widely utilized in industry as food/feed supplements. Protein concentrates are available from several plant sources such as soybean, whey, maize, etc. The potential of cassava as a protein rich source can be exploited by the preparation of leaf protein concentrates (LPC) which can replace/supplement available protein concentrates for food/feed purposes. Reports on the nutritional characteristics of cassava LPC are scanty and conflicting. Studies on the amino acid composition of cassava leaf protein (CLP) showed that, with the exception of methionine, the essential amino acid values exceed those of FAO reference protein.[3] The total essential amino acid content for CLP has been reported to be similar to that of hen egg and greater than that in oat, rice grain, soy seed and spinach leaf.[4] Fasuyi and Aletor[5] studied the varietal composition and functional properties of cassava leaf meal and LPC and reported that the amino acid profile of LPC showed a favourable balance of both essential and non essential amino acids especially lysine, leucine, valine and tryptophan, while the limiting amino acid was methionine. Other reports show that the limiting amino acid in cassava leaf is lysine, not methionine.[6] Ngudi et al[7] reported that although the protein content of cassava leaves was high, the quality was poor since sulphur amino acids were limiting, and in some cases lysine and leucine as well. Digestibility values of LPC has been found to vary from 80-85% in young leaves[1,8] to 67% in older leaves.

A major limiting factor in the utilization of cassava leaves as food is the presence of high levels of cyanoglucosides. However the leaves also contain high levels of linamarase. Pounding and crushing of leaves releases hydrogen cyanide which can be removed by boiling or drying. Common modes of preparation of cassava leaf dishes in Africa yield foods with little or no risk of cyanide toxicity. What remains to be established is the nutrient retention and bioavailability in processed cassava leaves and the efficiency of cyanide removal by other types of processing. More research on the nutritive aspects of cassava leaves is needed.

Our studies on the processing of cassava leaves have shown that when leaves are chopped and cooked in boiling water for 15 min, about 85% of cyanogens are removed. When leaves are pounded or crushed and then cooked, about 97% cyanogens are eliminated. Boiled leaves do not contain acetone cyanohydrin or free cyanide.[9] Sun drying of pounded leaves also removes 85% cyanogens. Sun dried leaves can be

processed by boiling, to eliminate the remaining cyanogens. Bokanga[2] also reported that pounding fresh leaves followed by 15 min boiling reduced cyanogenic glucosides to less than 1% of the initial level.

For the full nutritional potential of cassava leaves to be realized, research efforts must focus on development of simple, low cost but efficient techniques that would eliminate cyanogens, reduce other anti - quality constituents such as tannins and phytin and at the same time, retain nutrients such as proteins, carotenoids, and minerals. The resulting detoxified product could be used as a nutrient supplement. Development of CLP concentrates with high biological value and high digestibility would be another option. Such products would need to be completely free of cyanogens.

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Konzo, cassava foodborne paralysis - Cameroon: refugees

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Most of the 45 000 Central African Republic (CAR) refugees living in eastern Cameroon are diseased, malnourished, and generally in bad health, non-governmental organisation (NGO) and UN workers say.

The refugees arrive 'very weakened, after long days of walking and a lot of stress and they live in very difficult conditions,' Eric Grimaldi of Medecins Sans Frontieres (MSF) told IRIN. Once settled in some 60 villages in eastern Cameroon, their health does not improve significantly. For every 10 000 people, there are between 3 and 7 deaths per day among the refugees. According to MSF, the situation is particularly bad in the village of Ngaoui in Adamaoua Province, home to 5000 refugees and receiving 100 new refugees a month.

According to the UN Children's Fund (UNICEF), 17.2 percent of refugee children under 5 are malnourished. MSF has registered several cases of tuberculosis and about 50 cases of a rare paralytic disease called 'konzo.' Known as 'the disease of the poor,' it results from exclusive consumption of the bitter manioc [cassava] plant, which, though inexpensive, is poor in vitamins and nutrients.

Manioc also contains cyanide [linamarin], which can be toxic if improperly cooked. The result can be irreversible paralysis of the lower limbs, as well as hearing and sight problems.

'We have met families where several children are now paralysed,' MSF's Grimaldi said, adding that the Cameroonian authorities do not have the material or human resources to prevent the disease and very few doctors know how to treat it.

The nutritional situation was 'so alarming' according to MSF, that in July [2007] the UN Refugee Agency (UNHCR), the World Food Programme (WFP), MSF, and another aid agency, CARE, in collaboration with the Cameroonian Public Health Ministry, began monthly food distributions.

Communicated by:
ProMED-mail Rapporteur Brent Barrett

Konzo is characterised by an acute isolated and symmetrical hypertonic paraparesis, which is permanent but non-progressive. To date, 2 large epidemics have been reported, each of more than 1000 cases. The 1st was in the Bandundu region in Congo (1936-37) and the 2nd in the Nampula province of Mozambique (1981). Small outbreaks have been reported from Congo, Mozambique, Tanzania, and the Central African Republic. Sporadic cases of konzo also occur. The majority of cases of konzo occur in the dry season, chiefly during a long drought. Familial clustering is common.

Konzo begins abruptly. In 90 percent of cases the onset of symptoms takes less than a day. The initial symptoms are described as tremor, cramps, a heavy feeling, and/or weakness in the legs, a tendency to fall down, and difficulty remaining upright. There is a visible hypertonic gait when walking or running. Occasionally there will be lower back pain, blurred vision, speech difficulties, and/or paresthesia of the legs, but they disappear within a month. During the 1st 2 days the majority of patients have general muscular weakness and are confined to bed. Hypertonicity is present from day one. Flaccid paralysis of the limbs does not occur. Later there is a slight partial improvement. Finally the affected person develops a stable hypertonic paraparesis, which persists for the remainder of life, or might improve a little. After onset the neurological signs remain constant or improve minimally if no further cyanide is ingested.

Prevention of konzo therefore involves avoiding a farming system dominated by bitter cassava (which contains higher cyanide levels), insufficient cassava processing, and a protein deficient diet.

A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the International Society for Infectious Diseases
http://www.isid.org

History of cassava and konzo in Central Africa

Cassava (*Manihot esculenta*) belongs to the botanical family Euphorbiacea, and comes from northern Brazil, Peru and Colombia. The scientific world believes that cassava has its origin in the deep forests of the Amazon, where Indian tribes have resided for thousands of years, the Tupi, the Arawak, the Caribs, and the Tucano in the south-east of Colombia. These people managed to domesticate wild species of the cassava plant and make it their staple food long before Europeans visited the New World.

Cassava was introduced to the Europeans by Columbus. He got to know about this foodstuff during one of his trips to the West Indies when he went short of wheat and had to use cassava bread as a substitute.

Cassava was brought to Africa by Portuguese traders during the last half of the 16th century. History describes how the Portuguese approached the African coasts as they were the first Europeans to reach the upper Guinea Gulf. They became settlers at the mouth of the Congo River in 1482.

If we consider the exceptional collaboration between the King of Portugal and the King of Kongo, it is easy to imagine that the penetration into the unknown territories started from the mouth of the Congo River. This was done only by Africans themselves. Cassava was introduced into the immense hinterland of forests and savannah of the Congo basin and ended up on the western shore of Lake Tanganyika and further to the south to reach the country of present day Zambia.

This did not happen overnight, but lasted for two or three hundred years.

However, the world had to wait until the 20th century to realise that cassava was indeed the staple food for many tropical countries in Sub-Saharan Africa.

As population increases in Africa, there is an increased demand for food and cassava becomes more and more important.

The disease called konzo appeared much later. Konzo is present in many African countries. It is associated with the intake during a long time of exclusively bitter cassava, insufficiently processed.

Cases appeared in the Bandundu province during the period of the Belgian Colony and in Zaire after independence. The disease was observed in the 1930's, when it appeared as an epidemic in remote villages.

Konzo with its spastic symmetric paraparesis has a sudden onset. The disease does not progress, it does not respond to any treatment, but leaves the patient with permanent after effects. The disease was described for the first time by the physicians who worked for the organization called FOREAMI (The Funds of Queen Elizabeth for Medical Assistance to Indigenous People) in the Kwango region in the Bandundu province in 1936/1937.

Dr. Trolli, an Italian, during his long career as a physician in the Congo (1902 – 1932), was nominated head physician for the whole colony in 1925. He became General Director to FOREAMI in 1932. Trolli produced a report about the disease in 1938. As the disease had not been described before, discussion focussed on the aetiology and many doctors were of the opinion that the disease was of infectious origin, but others suspected alimentary implications or an infection from medicines.

Many studies have been carried out on konzo but nobody has ever been able to prove the presence of any bacterium or virus. Today there is little doubt that the disease is caused by cyanogens from insufficiently processed bitter cassava consumed monotonously for long periods in the dry season.

Cassava roots are rich in carbohydrates, and constitute an important source of energy, but are poor in protein and vitamins. Cassava is often cultivated on marginal soils, but still is a vital source of food production and cash crops in poor regions.

David Livingstone, during his exploration from South Africa to Luanda in Angola in 1849,visited villages where the people had never before seen a white man and mentioned that cassava was the staple food in the South Eastern region on the borders of present Democratic Republic of Congo (DRC).

It is estimated that more than 800 million people in the world in one way or other have cassava as a major part of their daily food. It is widely known that in DRC the people choose the bitter cassava for their culture rather than the sweet variety. They believe they get a better harvest that way, less diseases on the plants and fewer predators.

Migration from rural to urban areas is increasing with the demographic evolution in many African countries, and it is important to increase cassava production. It is necessary to find new species, and improve the resistance of the plant against diseases and predators. Many African countries have had uninterrupted socio-economical difficulties since independence, and these have often left populations in poverty. The starvation situation must be solved and is of great importance to any development project. Research Organisations like CIAT (Columbia) and IITA (Nigeria) are moving into new directions in their research. This research started in 1970, has produced new high yielding species resistant to diseases like 'cassava mosaic virus' and 'cassava bacterial blight' by interspecific hybridisation of wild species. Yields have also been increased.

The first International Conference in Hybridisation, Biotechnology and Ecology was organised in Brazil in November 2006. It is obvious that this was in the interest of Brazil and its needs, but also to Africa. It proved to be a springboard for many tropical countries, desperately in need of new methods, new technology and efficiency.

However there are important basic questions remaining to be answered, among other things how these new plants are going to behave under normal agricultural conditions, and how they are going to face the challenges of natural selection

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Getting the konzo prevention message out

It is good that the link between eating cassava containing high amounts of cyanide and konzo and other cyanide diseases is known. It is even better that a way has been found to reduce cyanide levels in cassava flour during preparation for consumption, making cassava safer to eat. However, unless the people who actually prepare and eat cassava share and act on this knowledge, the knowledge is wasted and people will continue to be afflicted from ingesting too much cyanide.

Earlier in 2007 a poster and brochure were produced that illustrate and describe the process for reducing cyanide in cassava flour. They were made with village people in mind so rural women could follow the instructions and be reminded of the steps to take by looking at the pictures.

Originally produced in Portuguese by Dr. Dulce Nhassico, the poster has been translated into English, French and Kifuliru (an African language used in Eastern DRC). **We want the poster translated into other African languages such as Swahili, so please contact us if you can help. Laminated posters can be sent free of charge by courier by contacting us**. (www.anu.edu.au/bozo/ccdn**)**

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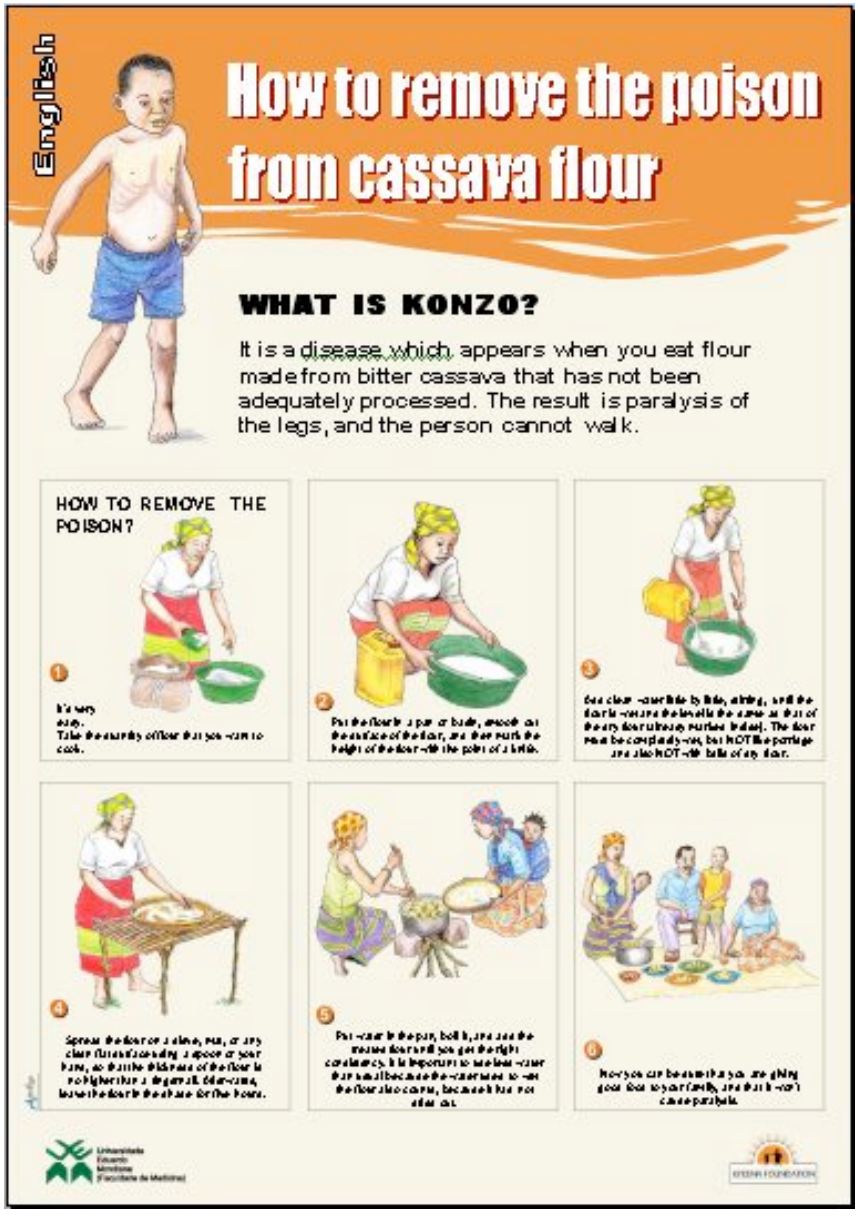

Above and below: Some of 428 students from the INSTITUT KALIMABENGE / KILOMONI, DRC Below: with KONZO posters in Kifuliru

CCDN News is the Newsletter of the Cassava Cyanide Diseases Network (CCDN). The CCDN is a free, worldwide network commenced in June 2001, which is working towards the elimination of konzo, TAN and other cassava cyanide diseases.

CCDN News will consider for publication short articles and letters (1-3 pages A 4 double spaced) written in English concerned with the following subjects:

1. Cyanide poisoning, konzo, TAN, goitre and cretinism facilitated by cyanide intake from cassava, and any other cyanide diseases.
2. Reduction of cyanide intake from cassava through agricultural and nutritional means such as by broadening the diet of cassava consumers through introduction of new crops, pulses, vegetables and fruits, and by reducing the cyanide content of cassava varieties through selection and breeding. The effect of environmental factors such as drought on cyanide levels in cassava.
3. Processing methods for conversion of cassava roots to stable food products of low cyanide content.
4. Other relevant matters of interest.

Because CCDN News is a newsletter, full-size original papers or reviews cannot be considered for publication.