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

CCDN News

Cassava Cyanide Diseases Network

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Contents

CCDN Coordinator:
Dr. J. Howard Bradbury
School of Botany and Zoology
Australian National University
Canberra ACT 0200, Australia
Phone: +61-2-6125 0775
E-mail: howard.bradbury@anu.edu.au
Coordinating Group:
Julie Cliff, Paula Cardoso, Arnaldo Cumbana (Mozambique);
Country Contacts:
Cameroon: E.E Agbor, .D.R. *Congo:* D.D. Ngudi, *India:* Bala Nambisan and K.T. Shenoy, *Indonesia:*A.Hidayat,*Mozambique* :Anabela Zacarias, *Nigeria.* M.N.Adindu.
Website:
www.anu.edu.au/BoZo/CCDN

How to identify konzo

Sometimes konzo is confused with other diseases when it appears in new areas. This confusion almost never happens in areas already affected by konzo, as people immediately recognize the characteristic way that konzo patients walk. We use criteria to distinguish konzo from other diseases.

Konzo criteria: the classic version

The three criteria for konzo proposed in a report from the Department of Nutrition, Uppsala University, in the World Health Organization Weekly Epidemiological Record [1] are:

1.Visible symmetric spastic abnormality of gait while walking or running.

Symmetric means that both legs are affected equally. In other diseases, one leg is often affected more than the other. For example, in a stroke, one side of the body is usually involved. In polio, one leg only may be weak.

Spastic abnormality of gait refers to the way konzo patients walk. This characteristic walk is called a "scissors" gait, because of the way patients cross their legs. Children born with spasticity due to a difficult birth also walk in this way.

2.History of onset less than one week followed by a non-progressive course in a formerly healthy person.

This criterion captures the sudden onset of konzo. In around 90% of cases the onset is in less than one day.

The sudden onset most readily distinguishes konzo from other causes of spastic weakness, which usually begin slowly. The only other similar disease that begins so suddenly and is non-progressive is lathyrism, due to consumption of the grass pea, *Lathyrus sativa.*

Non-progressive course means that the patient's disease does not get worse.

This non-progression should not be confused with further episodes of konzo. Patients may suffer further attacks, if they continue with the same monotonous cassava diet.

Also they may develop contractures of their joints due to their paralysis. If a patient can't move a joint, it may become permanently fixed in a contracted position. These

contractures worsen the disability.

3.Bilaterally exaggerated knee or ankle jerks without signs of disease of the spine.

Health workers usually measure these reflexes by tapping the knee or ankle with a hammer. A brisk jerk suggests that the reflex is increased.

These reflexes are used to distinguish spastic from flaccid paralysis (see below).

A disease of the spine may also cause paralysis. Sometimes this can be seen on examining the spine, for example, in tuberculosis of the spine, there may be a hump or lump. Diseases of the spine usually cause other symptoms, such as loss of sensation in the legs, that are absent in konzo.

Konzo criteria : a new version

Recently, Tshala-Katumbay[2] has proposed new criteria:

1.Sudden onset of a non-progressive bilateral and symmetric spastic abnormality of gait while walking or running.

This criterion captures the sudden onset, but patients whose disease begins more slowly may be excluded.

2. Bilaterally exaggerated knee or ankle jerks.

3. Absence of objective sensory and genitourinary symptoms

This criterion will exclude many other causes of paralysis, but could cause problems in some circumstances.

Konzo patients often describe abnormal sensations in their legs at the beginning of their disease, hence the use of the word *objective*, which means the symptoms should be confirmed on examination. But in Mozambique, we have found that patients sometimes have diminished sensation in their feet, probably due to associated poor nutrition. So this criterion may not always work in practice.

Genitourinary symptoms may occur in disease or injury of the spine. The usual symptoms are urinary incontinence and impotence, which are absent in konzo. Hence their presence excludes konzo.

4. Living under conditions of subacute or chronic exposure to cyanogens at the onset.

This criterion is always present in konzo. As the cyanogens referred to come from cassava, it would perhaps be clearer to say subsisting on a monotonous diet of cassava.

Acute spastic vs acute flaccid paralysis

Flaccid paralysis is different to spastic paralysis: the affected limb is floppy (flaccid) and reflexes are absent.

If in doubt, inform health authorities. If not in doubt, still inform, but don't notify as acute flaccid paralysis. Don't let konzo become a forgotten disease.

References

[1]Konzo – a distinct type of upper motoneuron disease. Weekly Epidemiological Record 71: 225-228, (1996)

[2]Tshala-Katumbay D. On the site of the lesion in konzo. Clinical and neurophysiolodical studies on a non-progressive upper motor neuron disorder. Acta Universitatis Upsaliensis, Uppsala 2001, 55-56.

Julie Cliff

jcliff@tropical.co.mz

Significance of hydroxynitrile lyase in cyanogenesis in cassava

The enzymes linamarase and hydroxynitrile lyase (HNL) control the degradation of linamarin to cyanide in cassava. The rate of breakdown of linamarin to its hydrolytic products, acetone cyanohydrin and cyanide varies significantly in different cassava tissues, the factors responsible being the tissue distribution, activity and compartmentation of the two hydrolytic enzymes. Rapid loss of hydrogen cyanide (HCN) occurs only when adequate amounts of linamarase and HNL are present.

During cassava processing, the elimination of linamarin from leaves/roots is often brought about by the action of linamarase and HNL which hydrolyse linamarin to form HCN, that is readily removed at temperature above 26° C, its boiling point. In leaf tissues the presence of high activities of linamarase and HNL ensure rapid loss of HCN resulting in a rapid reduction of linamarin levels. The peel or rind tissues of the root have a high activity of linamarase but negligible HNL. This results in rapid hydrolysis of linamarin to acetone cyanohydrin which then undergoes non enzymatic degradation to cyanide, due to lack of HNL. This process is slow and as a result there is subsequent accumulation of acetone cyanohydrin. In the inside of the root or parenchyma, the low activity of linamarase and absence of HNL results in a slower degradation of linamarin as compared to the other two tissues.

It was observed that addition of exogenous HNL to parenchyma or peel homogenates

accelerates the rate of loss of HCN due to faster degradation of acetone cyanohydrin. Therefore the use of exogenous enzyme would help in faster removal of cyanogens during cassava processing and lower the retention of acetone cyanohydrin in the final product. The HNL enzyme can be easily purified from cassava leaves. The enzyme is moderately stable and can be stored for two months at about 40° C without loss of activity.

Bala Nambisan

balanambisan@yahoo.co.uk

Konzo Count

A WHO Report of an outbreak of konzo in Mtwara region of Southern Tanzania adjoining Mozambique (see CCDN News 3) recorded a total of 17 villages affected in Mtwara and Newala rural districts. There were 214 people affected from poor families whose staple food was cassava flour used to make a stiff porridge. In the year of the outbreak (2003) there was a drought so they did not harvest maize or millet and were dependent on cassava as their only or main source of food. Cassava roots were dried for 1-3 days only, whereas normally they are dried for 2 weeks under the kitchen roof. The type of cassava used is mostly bitter cassava, which is mostly preferred because wild pigs and other animals do not consume it. The main recommendations from the report are as follows:

1.Adequate processing of cassava by fermentation and drying should occur over a longer time (one month) and the people should be provided with food aid over this period.

2.Encourage farming of sweet instead of bitter cassava.

3.Other food crops that withstand drought should be grown.

4. Health education should be given and detailed food security analysis should be done so that steps are taken to overcome the food problem and konzo.

It is interesting that these recommendations from the WHO Report correspond with the four point strategy developed to eliminate konzo, which resulted from a Workshop in Nampula, Mozambique in 2000[1]. This confirms the correctness of the four point strategy.

In Mwesthi health zone area in Western Kasai province of DR Congo about 22 cases of konzo have been reported by the NGO, Medecins du Monde.

We thank readers of CCDN News who have provided information about konzo and ask that you please continue to inform us of outbreaks and other information including the number of cases.

Reference

[1]CCDN News No 1, 2003, P.2: Ernesto, Cardoso, Nicala, Mirione, Massaza, Cliff, Haque & Bradbury, Roots 8, No 1, Dec 2002, 8-11.

Wetting Method to Reduce the Cyanide Content of Cassava Flour

The simplest method of making cassava flour is by sun drying. In this method the root is peeled to remove the high cyanide skin and the root, often cut longitudinally into halves is dried in the sun for about one week, or in the shade for two weeks, until it is dry and brittle. It is then pounded into a powder in a wooden pestle and mortar and sieved to remove strings. The white flour is stable and may be stored until used as food.

This traditional method is used with some modifications in many parts of the world including East, Central and Southern Africa, in Ghana where it is called *konkonte* and in Indonesia where it is called *gaplek* .

This method has been mechanised and speeded-up using mechanical dryers operating at temperatures up to 100° C and mechanical grinders. However, linamarase is progressively inactivated or denatured at root drying temperatures above 80° C , hence residual linamarase present may only break down the linamarin slowly to acetone cyanohydrin, which is unstable above pH 5 and forms HCN gas. Furthermore, the shortened times of treatment may not allow enough time for residual linamarase to break down the linamarin. Thus, care must be taken to avoid drying temperatures above 80° C and to allow sufficient time for linamarase breakdown of linamarin. Factory produced cassava flour should be tested using cassava cyanide kit B2, available free of charge from Dr Bradbury to health and agricultural workers in developing countries.[1]

Unfortunately the traditional sun drying method leaves a large amount of linamarin remaining in the cassava flour, amounting to 25-50 % retention of cyanide[2]. Because of the large amount of moisture present in cassava roots (about 63%) and the relatively small amount in cassava flour (<10%), the root cyanide level must be low (12-16 ppm) in order to get flour of 10 ppm cyanide content, which is the WHO safe standard.[3]

In practice, the WHO safe standard of 10 ppm can only be

achieved by sun drying roots of sweet cassava. The average cyanide level in cassava flour in Indonesia, Ghana and in Mozambique in a good year is about 45 ppm. In a year of low rainfall the average cyanide content of flour in Mozambique exceeds 100 ppm, which causes acute intoxication and konzo.[3,4]

This very bad situation is alleviated to some degree by the processors who, during periods of high flour cyanide, turn to heap fermentation[4]. In this method the peeled roots are piled in a small heap for about four days causing some fermentation and loss of cyanide. This is followed by the normal period of sun drying, crushing and sieving, to produce a slightly darkened product which has about one half of the cyanide content of that produced by sun drying.

Unfortunately, this expedient is nowhere near sufficient to make the cassava flour safe for human consumption, particularly in times of drought when cyanide levels in the root more than double, but until now it appeared to be the only means available to traditional processors.

We have developed a new simple wetting method that reduces the cyanide content of flour to about one third of its previous level.[5]

The method involves mixing thoroughly a sample of cassava flour with water in the ratio of four parts of flour to five parts of water. All the water is absorbed rapidly by the flour and the mixture is left in an open vessel at about 30° C for about 5 hours. The water rapidly swells the flour and allows linamarase to hydrolyse much of the linamarin with evolution of HCN gas. After about 5 hours the damp flour is used for cooking.

The method works only when there is sufficient linamarase present in the flour. For example, if the linamarase has been inactivated by prior drying of the root at 100° C, then there is no loss of linamarase using the wetting method. Conversely, if additional linamarase is added then the rate of breakdown of linamarase is increased.

The method is designed so that the flour needed for cooking in the evening is thoroughly mixed with water in the morning and used that same evening. Further work is in progress in Mozambique on the possible application of this promising new wetting method .

References

[1]CCDN News No 1, June 2003, P.1.: Bradbury, Egan & Bradbury J. Sci. Food Agric., 79, 593-601, (1999).
[2]Mlingi & Bainbridge, Acta Hort. 375, 233- 239, (1994).
[3]Cardoso, Mirione, Ernesto, Massaza, Cliff, Haque & Bradbury J. Food Comp. Anal. (2004), in press.
[4]Ernesto, Cardoso, Nicala, Mirione, Massaza, Cliff, Haque & Bradbury. Acta Tropica 82, 357-362, (2002).
[5]Bradbury, J. Food Comp. Anal., submitted for publication.

J. Howard Bradbury

Howard.Bradbury@anu.edu.au

Correction

In CCDN News 3 it was incorrectly reported that there was an outbreak of konzo on Pemba Island in northern Tanzania. A subsequent report showed that the unknown neurological disease produced an occurrence of numbness and loss of sensation which was reversible on multivitamin therapy. It was definitely not konzo!

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. Chemical analysis to determine the total cyanide content in cassava roots and products and thiocyanate in urine.
5. Other relevant matters of interest.

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