

Limbs' Malformation in Southern Nigeria—Garri (*Manihot Esculenta*) a Probable Cause

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ABSTRACT Data were collected on sixteen cases with severe malformations of bones of children born to mothers who consumed *Manihot esculenta* during their early period of pregnancy. This plant has high hydrocyanic acid (HCN) content as compared to the same plant of high quality. The methods of prevention of these malformations are also suggested.

Nigeria is a giant of Africa. It has not only the largest population than any other African country, but also vast resources like petroleum, forests, etc. It is the nation of 250 groups each of which has its own language or dialect. 47% of the total population of the country is of Muslims, settled in the northern part, whereas the other majority group inhabiting the southern part, consisting of 35% of the population, is of Christians. The chief occupations of the people are agriculture, forestry and fishing. Although the food crops are cassava, yam, maize, rice, millet and banana, the staple diet of the people mainly consists of cassava, yam and maize. Cassava, locally called GARRI, botanically known as *Manihot esculenta*, is usually taken in variety of cooked forms. Unfortunately cassava has been found to have a high concentration of hydrocyanic acid (HCN).

Singh (1981) reported that when cassava powder is consumed by pregnant rats as 80% of their diet during the first fifteen days of gestation, it proved teratogenic causing malformations of bones, growth retardation and even death. It has also been observed that various types of neuropathies in human beings are caused by the consumption of cassava.

MATERIAL AND METHODS

In a period of six months, the mothers of 228 deformed babies who attended the club foot clinic of University of Benin Teaching Hospital, Benin City, Nigeria, were interviewed regarding their dietary habits and the consumption of any other teratogenic material. 212 cases were treated for correction of clubfoot, whereas sixteen cases with severe malformations of the limbs were followed and observations presented in this paper. Mothers of these sixteen severely deformed babies had positive history of eating cassava as their main staple diet alongwith fish and beef stew during the period of their pregnancy. Green vegetables and fruits were not liked by these mothers. All these mothers were from the poor illiterate families of southern part of Nigeria and a majority of them belonged to the coastal area of Warri.

ANALYSIS OF CASSAVA SAMPLES

The samples of cassava powder taken as their staple diet by the mothers of patients, were collected and analysed to find out the content of cyanide (HCN) in them by the standard methods

given by Hamilton and Simpson (1960). The analysis of these samples showed that cyanide was present between 0.20 to 0.76% of dry weight and which undoubtedly is in significant quantity. As a control, the best quality of cassava samples were also purchased from the market and analysed for the cyanide content. Surprisingly these samples of best variety of cassava did not have any detectable amount of cyanide in them.

OBSERVATIONS

Sixteen cases of severe limb malformations noticed were ranging from soft tissue involvement to complete aplasia of tubular bones like radius, tibia, fibula and phalanges. Involvement of ulna, humerus, pectoral girdle in the upper limb; and femur and hip girdle in the lower limbs were not existing. In thirty two upper limbs, the thumb involvement was maximum (31%), and the involvement of second, third and fourth finger was 28%. Fifth finger involvement was only in one case, where all the phalanges of both the hands and feet were absent. In lower limbs, the involvement of big toe and other toes was 12% and in fibula 22%. Tibia was partially absent in 2 limbs and in one limb it was small in size. Femur and hip girdle were not involved. In one case syndactyly was observed in both the feet of the patient.

DISCUSSION

It is evident from the above observations that by and large the limb malformations in this group of patients studied had a reduction tendencies. Mildest form of involvement of thumb muscles with thumb and hand deformities were in six hands. In these cases, with reduction in skeletal material, bones were either deformed or absent. The total aplasia of bone was restricted to fore limbs and leg region only.

Henkel et al. (1969) observed that when looking at the axis of malformations in dysmelia in the upper limb, pre-axial border involvement dominated. Thumb was involved in maximum

cases and next were second, third and fourth fingers. The fifth finger was least affected. Ulna was always affected. The characteristic pattern, however, was not followed by the lower limb bones. In the lower limb it was fibula which was mostly affected, i.e. 22% and the tibia in 9% of limbs. It is rather difficult to explain these paradoxical findings.

As the women have not taken any other teratogenic material in their diet except the poor quality and cheap variety of cassava containing 0.20 to 0.76% of HCN, during the period of their pregnancies, the malformations enumerated above, can only be ascribed to this cassava powder. HCN is said to interfere with body oxidation processes. The traces of HCN in the blood tissue cells paralyse the enzyme cytochrome oxidase which normally oxidises cytochrome to the form in which it can transport oxygen to various tissues of the body. By paralyzing this enzyme, HCN suppresses the tissue oxidative processes leading to tissue anoxia. The consequences of this anoxia is cell death and/or damage of developing peripheral nerves and subsequent failure of development of soft tissue and bones. Thus the high concentration of HCN in cassava appears to be probable cause of high incidence of limb malformation in the population of southern Nigeria. *Manihot exculenta* tuber of this region is already known to contain higher percentage of HCN as compared to the tubers from other regions of the country.

Ignorance on the part of mothers who come from the remote, isolated, backward villages coupled with poverty are the most compelling factors for them to take this high HCN containing cassava in their diet, resulting in the limb malformations. The pregnant women should be advised, educated, discouraged and possibly prevented from taking cassava or any of its products in any form, in their daily life, especially during the first four weeks of their pregnancy. The ideal would be to ban the cultivation of cassava in this region. This task, though difficult, is not impossible to accomplish and can be achieved by finding out safe, suitable and acceptable substitute

to cassava. If at all, the cassava has to be taken, it must be processed by thorough washing and properly cooking so as to destroy the HCN content present in it. In this way only the malformations of the type described above in the children to be born, could be reduced, if not completely eradicated, for some would continue to remain ignorant and would continue to take *Manihot esculenta*.

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