Chemical Studies and Nutritive Properties of Some Nigerian Vegetables and Cereals —A Literature Review

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Animal products, cereals, tubers and vegetables constitute the principal sources of food in Nigeria. Cereals and vegetables assume even greater importance since financial restrictions severely limit the ability of the vast majority of Nigerians to avail themselves of ample supplies of animal proteins.

The object of this review is to survey the available data on the chemical composition of Nigerian vegetables and cereals and correlate such information with the nutritive properties of the vegetables and cereals.

One however recognises that documented and scientific information on this subject is scanty. Except for the pioneering efforts of Oke[1] and Oyenuga[2], the field is a virtually untapped one in which further research is clearly indicated.

Vegetables:

Of the many species of plants used as vegetables in the Nigerian diet, ten have been analysed by various methods, including flame-photometry, spectrophotometry and tritimetry, for crude protein, fat, crude fibre, ash content (including further analysis for the constituent mineral elements), oxalic acid, hydrocyanic acid and ascorbic acid content. The vegetables include: **Corchorus olitorus** (Oyo), **Celosia argentea** (Soko), **Talinum triangulare** (Gbure), **Amaranthus candatus** (Tete), **Celosia laxa, Solanum melongena, Solanum nodiflorum** (Ogunmo), **Vernonia amygdalina** (Ewuro) **Citrullus vulgaris** (Water-melon), **Hibiscus esculentis** (Okro).

Cereals:

The scanty information in the literature on Nigerian cereals contrasts sharply with their importance as primary sources of carbohydrates (second only to tubers—yam, cassava, cocoyam) as well as protein in the menu of the average Nigerian. Corn, sorghum and rice have been investigated by Oke[3] for crude protein, fat, crude fibre, carbohydrates, ash, including constituent minerals, oxalic acid, hydrocyanic acid and phytic acid.

From investigation by Oke[1-3] it is clear that these vegetables have (*i*) high protein content and therefore constitute good sources of protein especially if the rate of intake is high; and (*ii*) high ash content.

With the exception of **S. melongena,** which is not rich in calcium, the vegetables are good sources of Calcium, Phosphorus and Iron. Oxalic acid content is a recognised index of the quality of vegetables since large amounts would lead to poisoning and attendant lowering of the nutritive potential of the vegetables. However, the toxic effect of oxalate occurs when it is in solution (usually as its K or Na salt). Thus if the oxalic acid can be converted into insoluble oxalates (Ca and Mg salts) then a high oxalic acid content may not necessarily connote lowering of nutritive value since most of the oxalic acid would be converted into the insoluble salt if the calcium content of the vegetable is high.

Hydrocyanic acid (HCN) occurs in plants in the form of glycosides and hydrolysis leads to liberation of the HCN in conjunction with sugars and other chemicals that were combined in the original glycosides.

It is found that the HCN content of these vegetables is low and well below the toxic level. Furthermore, the little amount present is further reduced during cooking because of its loss on boiling.

Cassava is one of Nigeria's staple food crops and ranks first in production tonnage. It occurs in many varieties classified broadly as 'sweet' and 'bitter'. The former can be beaten on boiling. The latter contains a cyanogenetic glycoside 'limarin', which undergoes enzymatic hydrolysis to glucose, acetone, and HCN. However, traditionally, the preparatory processes prior to eating usually guarantee removal of the prussic acid. Cassava is normally eaten boiled, grated (gari) or after fermentation to give Lafun (powdered cassava.)

There is rather a wide variation in the crude protein content of cassava (2.58%) as compared with lafun (0.07%). This underlines the need to eat lafun with good vagetable soup rich in fish or meat protein. HCN occurs in quite a high concentration in cassava and represents a potential source of food poisoning. However, most of the prussic acid is lost during fermentation of cassava and the subsequent drying to yield lafun. Consequently, the amount of HCN in lafun is quite low and does not constitute a dietary hazard.

The results of work done on the ascorbic acid content of some Nigerian vegetables under three different conditions, viz: before cooking, after cooking and after sun-drying for three hours, showed that that with the exception of **Celosia argentea** (Soko) which contains 18 mg of ascorbic acid per 100 g of vegetable, all others have a high ascorbic acid content ranging from about 30 mg to 100 mg. In all cases investigated, the ascorbic acid content was shown to be greatly diminished by boiling the vegetable or exposing in the sun's heat, therefore mild steaming of the vegetables or their more widespread use in the form of salad would be more beneficial.

Oke has also shown[3] that the crude protein contents of Nigerian corn (11.8%) and Sorghum (13.0%) are high when compared with similar cereals from some other countries. These cereals therefore represent good sources of protein since the average Nigerian adult could consume about 200 g dry matter per day. Rice however has low protein content.

Although the information available is scanty, some reflections can be made with regard to the chemical constitution and nutritive potential of Nigerian vegetables and cereals.

1. The available species of edible cereals and vegetables are of a wide range and because they are rich in protein content if taken in quantities traditionally consumed, represent adequate sources of protein for a normal diet.

2. The vegetables have a high ash content and would seem to be important source of dietary Ca, P, Mg, Fe and other minerals. Although the Ca: P ratio does not always correspond to the ideal value of 1:2, it would be misleading to infer that Ca deficiency is an attendant danger since the amounts of soluble oxalate in all cases investigated so far are relatively low and well below the toxic level.

3. Except in cassava, HCN is present only in trace amounts, and the danger of poisoning resulting from cyanogenesis can be discounted. Even in cassava the preparative method employed in the conversion of the tuber to its edible form guarantees the removal of practically all the prussic acid present originally.

4. Nigerian vegetables are important sources of ascorbic acid. However, since the amount of vitamin C available is grossly reduced by drying, witting and boiling, it would be necessary to design methods to preserve the vegetables so that they can retain their freshness, and also the traditional cooking techniques need modifications in order to guide against substanital loss of this vitamin.

5. The vegetable **Citrullus vulgaris** (water-melon) is of high calorific value and also serves as a most important source of both lipids and proteins. Its widespread traditional use as a dietary item thus reflects its scientifically determined properties.

In view of the particularly useful properties of this vegetable its increased production seems indicated. Methods for maximizing such production as well as extracting the nutrients most efficiently could prove a fertile area of collaborating inter-disciplinary research workers in such areas as agriculture, chemistry, biochemistry and food science. The possible uses of the oil as pharmaceutical intermediate and the cake as cattle fodder need to be investigated.

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