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Antinutritional Factors in Selected Legumes and Vegetables Consumed in Sokoto

L. S. Bilbis, D. A. Almustafa, R. A. Shehu and M. G. Abubakar

Department of Biochemistry, Usmanu Danfodiyo University, Sokoto, Nigeria.

ABSTRACT: Cyanogenic glycosides, Phytic acid, total and soluble oxalates are common antinutrients associated with plant tissues. The levels of these substances were determined in the leafy vegetables "Zogala" (*Moringa-preygospernia*), spinach (*Amaranthus cardalus*), Bitter leaf (*Veronica amydalina*) and "Yakuwa" (*Hibiscus sabdariffa*) and the legumes, Cowpea (*Vigna unguiculata*), Groundnut (*Arachis hypogoa*), Bambara nut (*Voanzela subrra*) and soybean (*Glycin max*) which are commonly eaten in Northern Nigeria. The results show that the legumes exhibited the highest mean values of all the antinutrients with cowpea and Bambara nut exceptionally high in cyanogenic glycoside and oxalate respectively. "Zogala" with the highest antinutrients among the vegetables has only about 40 - 50% of the highest levels found in the legumes. A significant ($P < 0.05$) decrease in the levels of all the antinutrients in all samples was observed after cooking. The decrease was significantly ($P < 0.05$) higher in the legumes compared with the vegetables.

INTRODUCTION

Vegetables and legumes, in conjunction with cereals, are the commonest foods consumed in Northern Nigeria. This is attributable to the fact that they are abundant and relatively cheap. Although they are nutritious, they also contain antinutritional factors which interfere with the bioavailability or utilization of some of the nutrients they contain. It is well established that oxalates, when present in foods, interfere with the assimilation of calcium (1 - 3). Phytic acid can also combine with calcium, zinc or iron and render them insoluble and therefore nutritionally unavailable (4). In addition, Phytin, a complex of phytic acid and calcium can interact with dietary protein and as a result, reduces its solubility.

In this study, the levels of cyanogenic glycosides, phytic acid, total and soluble oxalates were estimated in both raw and cooked samples, with a view to evaluating the effect of cooking on the levels of these substances as they have a considerable importance to nutrient availability and toxicological evaluation of these foodstuffs widely consumed in the northern part of Nigeria.

MATERIALS AND METHODS

Cyanogenic glycoside, Phytic acid, soluble and total oxalates in selected raw and cooked legumes and vegetables were determined. The legumes used in this study are: Cowpea (*Vigna unguiculata*), bambara nut (*Voanzola subarra*) Ground nut (*Arachis hypogea*) and soybean (*Glycin max*). The vegetables are: "Zogala" (Moringa Preygospernia) Spinach (Amaranthus Cardulas), Bitter leaf (*Veronica amydalina*) and "Yakuwa" (*Hibiscus sabdariffa*). The samples were purchased fresh from Sokoto Central Market. They did not show any visible sign of physical damage or fungal infestation. The determinations were carried out as described by Allen *et al* (5). All chemicals used in this study were of analytical grades.

Table 1: Antinutritional Factors in raw and cooked selected legumes and vegetables.

Food Item	Cyanogenic Glycoside (mg%)	Phytic acid (ppm)	Soluble oxalate (mg%)	Total oxalate (mg%)
Cowpea:				
(Raw)	115.6 ± 0.58	60.3 ± 0.57	55.5 ± 0.86	175.6 ± 0.58
(Cooked)	35.3 ± 0.51	2.56 ± 0.51	44.0 ± 0.00	116.1 ± 0.17
Bambra Groundnut:				
(Raw)	55.16 ± 0.28	21.6 ± 0.11	110.2 ± 0.28	351.8 ± 0.29
(Cooked)	21.8 ± 0.29	7.0 ± 0.00	70.2 ± 0.25	263.6 ± 0.58
Soya Bean:				
(Raw)	63.3 ± 0.57	20.6 ± 0.12	49.3 ± 0.57	132.0 ± 0.00
(Cooked)	20.0 ± 0.00	5.66 ± 0.58	33.3 ± 3.33	56.0 ± 0.00
Groundnut:				
(Raw)	52.2 ± 0.28	31.16 ± 1.04	16.0 ± 0.00	88.0 ± 0.00
(Cooked)	15.0 ± 0.00	15.0 ± 0.00	5.43 ± 0.40	71.6 ± 0.58
Zogala:				
(Raw)	67.3 ± 0.5	43.0 ± 0.87	40.0 ± 1.00	82.33 ± 1.20
(Cooked)	54.7 ± 0.10	10.0 ± 0.00	25.4 ± 0.00	67.00 ± 0.00
Spinach:				
(Raw)	58.24 ± 0.00	28.7 ± 1.20	38.0 ± 1.00	73.0 ± 0.00
(Cooked)	39.54 ± 0.40	15.8 ± 1.40	31.0 ± 1.00	58.33 ± 0.60
Bitter Leaf:				
(Raw)	55.76 ± 0.25	30.4 ± 0.36	44.0 ± 0.24	80.22 ± 0.26
(Cooked)	33.50 ± 0.50	22.13 ± 0.40	33.46 ± 0.26	60.2 ± 0.03
Yakuwa:				
(Raw)	47.85 ± 0.13	19.30 ± 0.44	27.66 ± 0.30	40.09 ± 0.11
(Cooked)	25.92 ± 0.27	13.22 ± 0.26	16.68 ± 0.12	30.59 ± 0.06

RESULTS AND DISCUSSION

The results of this work indicate that the raw legumes exhibited the highest mean values of all the antinutrients. The cyanogenic glycosides ranged from 52.2 ± 0.28mg% (G/nut) to 115.6 ± 0.58mg% (Cowpea). Phytic acid ranged from 20.6 ± 0.12 ppm (Soybean) to 60.3 ± 0.57 ppm (Cowpea), soluble oxalates from 16.0 ± 0.08mg% (G/nut) to 110.2 ± 0.28mg% (Bambara nut) and total oxalates from 88.0 ± 0.00mg% (Soybean) to 351.8 ± 0.28mg% (Bambara nut).

Of the raw vegetables, "Zogala" had the highest values of all the antinutrients. The content of cyanogenic glycosides in general ranged from 33.5 ± 0.5mg% (Bitter leaf) to 67.3 ± 0.50mg% (Zogala), phytic acid ranged from 19.3 ± 0.44 ppm (Yakuwa to 43.0 ± 0.87 ppm (Zogala), soluble oxalates from 27.66 x 0. 30mg% (Yakuwa) to 44.0 ± 0.24mg% (Bitter leaf) and total oxalates from 40.1 ± 0. 11mg% (Yakuwa) to 82.3 ± 1.20mg% (Zogala). There is a statistically significant ($P < 0.05$) decrease in the levels of all the antinutrients in all the samples after cooking. The decrease in the legumes is significantly ($P < 0.05$) greater than in the vegetables. This decrease could have resulted from either destruction of the antinutrients or solubilization and subsequent leaching into the cooking medium, but most probably the latter. This is because the retention of the water used in cooking spinach in meals has been shown to interfere with the absorption of calcium (6). However, the problem encountered in many homes

is that, the water used in cooking, which now contains some of the antinutrients is often retained and consumed. This could lead to a substantial reduction in the availability of divalent cations such as calcium, iron and zinc, the absorptions of which are known to be antagonised by these antinutrients (7). Pingle and Romasustiril (6) reported the obliteration of the deleterious effect of *Amaranthus* sp. leaves on milk calcium absorption by not consuming the water used in cooking the leaves. However, although cooking leads to a substantial reduction in the level of antinutrients, the practice will also result in a considerable loss of some important water soluble nutrients compromised in the water used for cooking. Such nutrients include ascorbic acid, the B-Complex vitamins, minerals and soluble carbohydrates.

The consumption of spinach and cowpea is often recommended by clinicians to pregnant women in Northern Nigeria. This is because of their considerable nutritional value by virtue of their high contents of calcium, iron, ß-Carotene (in Spinach) and protein (in Cowpea). However, the results of this work indicate that the use of these vegetables by pregnant women should be re-evaluated vis-a-vis their content of these antinutritional factors.

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