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Determination of the Levels of Some Anti-Nutritional Factors and Effect of Processing Wild Bean (Vigna Racemosa) Seeds

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Abstract

This research project work was carried out to determine the level of some anti-nutritional factors and effect of processing on a variety accession number TVnu-22 of wild bean, Vigna racemosa. The processing methods were cold water soaking at room temperature 25°C, for 12 hours; warm water 40°C soaking for 1 hour; and cooking 103°C for 1 hour 30 minutes. Contents of the anti-nutrients (oxalate, phytate, cyanide and tannin) determined were using standard chemical procedures including Dye, Wheeler and Ferrel colorimetric method, Colorimetric and Varillin-HCl methods. From this study, it was found that levels of the anti-nutritional factors were quite high in the wild bean. Unprocessed wild beans contained 857mg/100g oxalate, 165mg/100g phytate, 1.250mg/100g cyanide and 43.2mg/100g tannin which were significantly ($P<0.05$) reduced to 367mg/100g, 43mg/100g, 875mg/100g and 20.0mg/100g respectively after cooking for 1 hour 30 minutes. Soaking in cold or warm water had no effect on the level of the anti-nutritional factors. Despite the effect of cooking on the antinutrients, their reductions were above the tolerance limits. Low level of antinutrients is an index of food safety in terms of chemical toxin to the body.

Keywords: Antinutrients; Undomesticated; Legume Vigna Racemosa; Processing

Introduction

Vigna racemose (wild beans) is a perennial climbing herbaceous leguminous plant, a wild pantropical of the genus Vigna with several species. It grows in the humid and sub-humid tropics. In West Africa savannah, wild beans also known as wild cowpea is considered as a unique crop and provides food for man and livestock. It is resistant to multiple pests and diseases that causes tremendous yield reduction in cultivated beans.

The seed is valued for its high protein content. Studies have shown that its protein content is higher than that of the conventional beans whose protein varies between 23-30%. It is also utilized as a quick growing cover crop to protect soil erosion as well as to improve soil fertility. Being a leguminous crop, wild bean has the ability to fix atmospheric nitrogen in the soil through symbiosis with rhizobium in the root nodules, thus improving the reserves of soil nitrogen.

Knowledge about the anti-nutritional factors present in the seed and how it can be detoxified to make it edible will make this crop not only valued for crop improvement programme but also boost its domestic use as food for man and livestock to compliment bean as protein source, hence, the objective of this study is to determine the concentration of anti-nutrients such as oxalate, phytate, cyanide and tannin that may be present in the seed and also to determine the effect of processing method such as soaking in cold water, warm water and cooking on the level of the anti-nutrients.

Materials and Method

Preparation of Sample for Analysis

The dried samples was grounded to a fine powder using mortar and pestle. This powder sample was the used for determination of Tannin, phytate, oxalate and cyanide.

Determination of Moisture Content of the Sample

The method was described by AOAC [1]. A clean crucible was weighed. About 10g of the finely grounded sample of the vigna racemose was placed in the crucible and reweighed. The crucible containing the sample was kept in hot air oven at 100°C for 24 hours. It was removed, cooled and weighed to constant weigh.

Determination of Oxalate

The oxalate was determined using Dye 1960 method.

Determination of Phytic Acid

Phytate Phosphorus was determined by the method of Wheeler and Ferrel colorimetric (1971)

Determination of Cyanide

The cyanide content of the sample was determined calorimetrically according to the method of Cooke (1978) and Kediobi (1980).

Determination of Tannin

Tannin was determined by varillin Hcl procedure.

Data Analysis

The data were statistically analysed using ANOVA.

Result

Weight of sample (g)	Weight of sample + crucible (g)	Weight of dried sample + crucible (g)
10	25	24.87
10	18	17.87
10	25	24.87

Table 1: Moisture Content of Vigna Racemosa.
Percentage moisture content 1.30 %

Treatment	Oxalate (mg/100g)
Raw	857 ± 0.18
Cold water soaking for 12 hours at room temperature	857 ± 0.18
Warm water soaking for 1 hour	857 ± 0.18
Cooking for 1 hour 30 minutes	367 ± 0.20

Table 2: Level of Oxalate (mg/100g) in Vigna Racemosa.

Treatment	Cyanide (mg/100g)
Raw	1,250 ± 2.70
Cold water soaking for 12 hours at room temperature	1,250 ± 2.70
Warm water soaking for 1 hour	1,250 ± 2.70
Cooking for 1 hour 30 minutes	875 ± 0.00

Table 3: Level of Cyanide (mg/100g) in Vigna Racemosa.

Treatment	Tannin (mg/100g)
Raw	43.2 ± 0.02
Cold water soaking for 12 hours at room temperature	43.2 ± 0.02
Warm water soaking for 1 hour	43.2 ± 0.02
Cooking for 1 hour 30 minutes	20.0 ± 0.32

Table 4: Level of Tannin (mg/100g) in Vigna Racemosa.

Treatment	Phytate (mg/100g)
Raw	165 ± 0.30
Cold water soaking for 12 hours at room temperature	165 ± 0.30
Warm water soaking for 1 hour	165 ± 0.30
Cooking for 1 hour 30 minutes	43 ± 0.08

Table 5: Level of Phytate (mg/100g) in Vigna Racemosa.

Discussion

Analysis for raw and processed vigna racemosa which are cold water soaking for 12 hours at room temperature, warm water soaking for 1 hour and cooking for 1hour 30minutes. The cold water soaking did not result in any significant difference in physical appearance when compared to the raw vigna racemosa and when the analysis were carried out on the anti-nutritional factors, there were no change in the value gotten compared to the value for the raw vigna racemosa. On cooking vigna racemosa for 1hour 30minutes, the beans broke opened, the variegated patches disappeared and it became softer. When dried, some of the seed coat were removed during pounding [2].

The moisture content was found to be 1.30% which is quite low, this indicates that vigna racemosa has a good shelf life. The moisture content of an item of food could be used as an index of stability and susceptibility to fungal attack.

Oxalate level was found to be 857 ± 0.18 mg/100g for all treatment given to vigna racemosa except for the cooking treatment which was found to be reduced to the range of 42.2 – 28.5 mg/100g for cowpea [3]. Oxalate elicits deleterious effect by binding some divalent mineral ions like calcium, magnesium, iron. Thereby limiting their bioavailability. Oxalate concentration higher than 2 – 5% is capable of exerting toxicological symptoms in man.

Cyanide analysis carried out on vigna racemosa was 1,250 ± 2.70 mg/100g for the first three treatments, while for cooking it was reduced to 857 ± 0.00 mg/100g. The value gotten was the range found for some plants 2.0 – 210.0 for kidney bean and Lima, even though cooking was found to reduce the level of cyanide in vigna racemosa. Processing of grain into products considerably reduces the level of hydrogen cyanide in finished products [4].

Tannin level contained in vigna racemosa was 43.2 ± 0.02 mg/100g and 20.0 ± 0.32 mg/100g for cooking treatment applied which showed reduction. Tannin level required for rejection in by grazing animals which is taken as toxicity level is 20mg/100g of dry matter. This indicates that the level of tannin in vigna racemosa make it not quite good enough to be incorporated into animal feeds even though cooking was found to reduced its level. But the result gotten was found to fall within the range 0.59 – 82mg/ 100g for lima bean and horse eye-bean. Tannin has been reported to have antioxidant activity due to preferential oxidation of polyphenolic moieties.

The phytate level in vigna racemosa was 165 ± 0.30 mg/100g and reduced drastically to 43.4 ± 0.08 mg/100g by cooking treatment applied. These range were within the range 51.0 – 203 for locust beans and groundnut. Phytate is another chelating anti-nutrient that forms complexes with divalent cations like calcium, zinc and protein, thereby reducing their bioavailability. Phytic acid have been found to have antioxidant activity and preventing dental caries in the formation of resistance enamel [5].

Conclusion

The observations of this study suggest that some anti-nutritional factors like oxalate, phytate, cyanide and tannin were found to be present in wild bean in significant quantities and that cooking process significant ($p1<0.05$) reduced the level of all the anti-nutrients found. But still despite this effect it did not reduced it to level of tolerance. Low level of anti-nutrient is an index of food safety in term of chemical toxin to the body.

Recommendation

It is therefore recommended that further studies be carried out to determine more anti-nutritional factors present in vigna racemosa and more effective method of processing should be looked into that could reduce the level of the anti-nutrients to such level that can be safely consumed by animals. Also offer boiling the beans for 1hour 30minutes the water should be discarded.

Conflict of Interest

We wish to confirm that there are no known conflict of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. No funding was received for this work

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