CHEMICAL COMPOSITION OF ACID AND ALKALINE SOAKED DEHULLED AFRICAN YAM BEAN SEEDS (*Sphenostylis stenocarpa*) SEEDS

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ABSTRACTS

African yam bean (AYB) (*Sphenostylis stenocarpa*) is an indigenous food legume crop in the tropics, but it is not as popular as food when compared with other major legumes. It is high in protein but it is under - utilized due to the presence of tannin, trypsin inhibitors, haemaglutinins, oxalates, phytates and saponins.. To improve its nutritional value as a protein source, AYB was subjected to dehulling, dehulled soaking in ogi liquor (acidic media) and dehulled soaking in wood ash (alkaline media) and its anti-nutritional contents analyzed. There were no significant (P>0.05) difference in tannin, phytate, saponin, and oxalate across the dietary treatments. However trypsin inhibitor and haemagglutinin showed significant (p<0.05) difference across the treatments. Raw AYB had the highest value for tannin (0.09/mg/g), phytate (0.67/mg/g), trypsin inhibitors (31.26/TIU/g), saponin (0.32mg/kg), haemaglutinnins (58.24HIU/g) and oxalates (0.25mg/g) followed by the dehulled seed with tannin (0.07/mg/g), phytate (0.49mg/g), trypsin inhibitor (11.34/TIU/mg), saponin (0.26/mg/kg) and haemmaglutinins (49.15/HIU/g). African yam bean soaked in alkaline media (pH 10) recorded the least value for tannin (0.05mg/g), phytates (0.05/mg/g), trypsin inhibitor (0.06/TIU/g), haemmaglutinins (6.35/HIU/g). The lowest value of oxalate was for AYB soaked in acidic medium (0.20mg/g). Soaking in alkaline medium (pH 10) was found to be more effective in reducing the levels of trypsin inhibitors activity and haemaglutinins by 99.8% and 89.1% respectively. However, soaking of AYB in (pH 3.9) resulted in 63.7% and 15.6% reduction in trypsin inhibitor activity and haemaglutinins respectively. It could be concluded that anti-nutritional factors present in African yam bean could easily be reduced when soaked in alkaline solution.

INTRODUCTION

The competition between human and animals for conventional protein sources and the high cost of compounding concentrate has been a major constraint militating against increase production of valuable source of animal protein (Ogunbanjo *et al.*, 2009). This has resulted in the search for alternative protein sources for livestock feeding (Dafwang, 2006). One of such alternative feedstuffs capable of substituting for the conventional plant protein is African yam bean (*Sphenostylis stenocarpa*). African yam bean is classified as a minor grain legume and according to (Moyib *et al.*, 2008). It is an important legume in Africa, a lesser-known legume of the tropical and sub– tropical areas of the world which has attracted research (Azeke *et al.*, 2005). The seeds are rich in protein (22-25%) with relative low fibre content of 10%. The protein is particularly rich in lysine up to 9% of protein, a value higher than that of Soyabean. However the use of African yam bean is limited by its long cooking period, tedious manual removal of skin coat, presence of anti-nutritional factor (tannins, trypsin inhibitor, hydrogen cyanide, saponins and phytic acid) limits its use in feed formulation (Akinmuntimi *et al.*, 2006). Processing methods such as heating, soaking, fermentation and toasting can be used to deactivate these anti-nutritional factors and improved nutritional value of African yam bean (*Sphenostylis stenocarpa*) and its by-product (Onyeike *et al.*, 1995).

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the Teaching and Research Farm, Oyo State College of Agriculture, Igboora, Oyo State

Collection of seeds: Wild African yam bean was purchased from Bodija market, in Ibadan.

Pre-treatment of seed: Raw AYB seeds were soaked at the rate of 1kg/3L of water for 12 hours after which the water was decanted and the bean dehulled.

Treatment of dehulled seeds: Dehulled AYB seeds were soaked at the rate of 1kg/3L of raw ogi maize liquor or 0.5% of wood ash solution for 24 hours, initial and final pH was taken. The samples were sundried for 3days, milled and packaged in a

transparent polythene bag for laboratory analysis of anti-nutritional factors.

Chemical analysis

The raw and processed African yam bean seeds were analyzed in triplicates for tannin, phytate, trypsin inhibitors, oxalate, phytate and heamaglutinins. Tannin was determined according to AOAC 1995, trypsin inhibitor activity and saponin were determined according to kakade *et al.*, 1974, oxalate according to Henry (1993) and haemaglutinin was determined according to Liener 1955.

Statistical analysis

Data collected was subjected to statistical analysis of variance (ANOVA) using SAS 1999 version and means separated by Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The anti-nutritional factor contents of raw and processed African yam bean seed meal are presented in table 1. There were no significant (P>0.05) different in the value obtained for tannin, phytate, saponin, and oxalate across the dietary treatment. However trypsin inhibitor and haemagglutinin showed significant (p>0.05) difference across the treatments. It was observed that raw AYB had the highest value for tannin (0.09/mg/g), phytate (0.57/mg/g), trypsin inhibitors (31.26/TIU/mg), saponin (0.32mg/kg), haemaglutinnins (58.24/HIU/kg) and oxalate (0.25/mg/g) followed by the dehulled seed with tannin (0.07/mg/g), phytate (0.49/mg/g), trypsin inhibitor (11.34TIU/mg), saponin (0.25/mg/kg) and haemmaglutinins (49.15/HIU/g).African yam bean soaked in alkaline medium recorded the least value for trypsin inhibitor (0.06/TIU/mg), and haemaglutinins (6.35/HIU/g). The lowest value of oxalate was for AYB soaked in acidic medium (0.13/mg/g). There were small insignificant (p>0.05) losses in tannin, phytate, saponin, and oxalate for dehulled AYB. Soaking of AYB in acid and alkaline media in the reduction of tannin, phytate, saponin and oxalate. The reduction observed in trypsin inhibitors and heamaglutinins for dehulled AYB indicated that the hull has considerable amount of these two anti-nutritional factors. However soaking of dehulled AYB in alkaline medium reduced the ANF(s) more than soaking in acidic medium. Soaking in alkaline was found to be more effective in reducing the levels of trypsin inhibitors and haemaglutinins. Maximum level of reduction in anti-nutrients by 99.8% and 89.1% was observed in trypsin inhibitor activity and haemaglutinins respectively which was contrary to the widely held view that trypsin inhibitors are easily denatured by heat only (Liener 1972). Also, soaking of dehulled AYB in acidic medium accounted for 63.7% and 15.6% reduction in trypsin inhibitor activity and haemaglutinins. This agrees with the findings of Ologbogbo *et al.*, 1993 who reported higher concentration of base soluble fractions than in other fractions indicating a greater extractability of anti-nutritional factors by alkaline treatment than by acid, ether or alcohol. Also, 63.7% and 15.6% reduction in trypsin inhibitor activity and haemaglutinins that was observed for dehulled AYB soaked in ogi liquor agreed with the findings of Akinmutimi (2004) who observed that most processing methods employed in improving the nutritive value of non-conventional feedstuffs do not completely eliminate ANFs but only reduce their concentration to tolerable levels in feedstuffs. However, the maximum reduction in the values of trypsin inhibitors and haemaglutinins recorded for AYB soaked in alkaline medium could be attributed to high solubilization of these anti-nutritional factors present in alkaline media

Conclusion

The results of the study indicated that the AYB seeds have good nutritional profile with high protein content and other nutrients comparable with that of other common legume grains. Among the various common processing methods employed, soaking in alkaline pH of 10.0 was found to be more effective in reducing various anti-nutritional compounds especially trypsin inhibitors and haemaglutinins present in AYB seeds. DAYBSO- Dehulled African yam bean soaked in ogi liquor (acidic medum). DAYBSWA- Dehulled African yam bean soaked in wood ash (alkaline medium).

REFERENCES

A.O.A.C (1995). Association of Official Analytical Chemist. Official methods of analysis 16th ed: William Tryd Press Washington D. C. USA Chapter 4 pp 17-34

Akinmutimi A.H. (2004). Evaluation of sword bean *(Canavalia gladiata)* as an alternative

feed resources for broiler chickens. Ph.D Thesis. Micheal Okpara University of Agriculture

Akinmutimi, A.H., Aligwara O.A. and Abasiekong S.F. (2006).The effect of quantitative replacement of soya bean meal with cooked and toasted Lima bean meal on growth performance and carcass quality value of broiler finisher birds. *J. Agric. Biotech Environment* 4: (1/2)

Azeke, M.A.B., Fretzdorft, H., Buencing, P., Fare, W., Holzapfel, T., and Betsche, (2005). Nutritional value of African yam bean (*Spenostylis stenocarpa*): Improvement by Lactic acid fermentation. *Journal of Food Science and Agriculture*.**85**(2): 963-970.

Dafwang, I.I. (2006). Milk egg and meat from farm wastes explorations in Animal Nutrition on Research and Extension. An Inaugural Lecture University Organised Lecture Committee. Vice Chancellors Office, Ahmadu Bello University , Zaria Nigeria 27-29 march

Henry, T.A (1993). The plant Alkaloids pg 6-466 Allens commercial organic Analysis, 1992, Vol. Vi: 167-170

Kakade, M.L. Hooffa, D.E and Liener, I.E. (1974). Contribution of trypsin inhibitors to the deleterious effects of unheated soyabeans fed to rats. Journal Nutrition 103: 1772-1779.

Liener, I.E. (1972). Toxic Effect of edible legumes and their elimination. American Journal of Chemistry and Nutrition. 11: 281-298

Liener, I. E. (1955). The photometric determination of haemaglutinin activity of Soyin and soyabean .*Extract Archives of Biochemistry Biopys* 5: 223-231

Moyibi. O.K., Gbedegesin. M.A., Aina. O.O. and Odunola. O.A. (2008). Genetic. Variation with a collection of Nigeria accession of African yam bean (*Sphenostyis stenocarpa*)revealed by RAPD. Primer *African Journal of Biotechnology Volume* 7. (12);1839-1846

Ogunbajo, S.A., Alemede, I.C., Adama, J.I. and Abdulahi, J. (2009). Haematological parameter of *savannah brawndo'*.34;88-91

Ologhobo, A. D.,. Apata, D.F. and. Oyejide, A. (1993). Utilization of raw jackbean *(Canavaliaensiformis)* and jackbean fractions in diets for broiler chicks.*Br. Poult. Sci.*, 34: 323-337.

Onyeike, E. O.,andAyalogu,S. G. (1995). Uzogora; Influence of heat processing African yam bean seed (*Sphenostylis stenocarpa*) flour on the growth weight of rats. Plant Foods for Animal Nutrition

SAS, (1999). Statistical Analytical Systems. User's guide. Version6. 3rd edition. Cary. North. Carolina. USA. 943.

Table 1: pH changes of dehulled African Yam bean soaked in ogi liquor and wood ash

pH range	DAYBSO	DAYBSWA
Initial pH	3.9	10.0
Final pH	4.5	5.3

DAYBSO- Dehulled African yam bean soaked in ogi liquor (acidic medium). DAYBSWA- Dehulled African yam bean soaked in wood ash (alkaline medium).

Table 2: Effects of processing on the anti-nutritional content of African yam bean seeds (*Sphenostylis stenocarpa*).

SAMPLE	Raw	Dehulled AYB	DAYBSO	DAYBSWA	SEM
Tannin (mg/g)	0.09	0.07	0.06	0.05	0.01
Phytate (mg/g)	0.57	0.49	0.35	0.32	0.05
Trypsin inhibitors (TIU/mg)	31.26^a	11.34^b	0.23^c	0.06^d	6.35
Saponin (mg/kg)	0.32	0.25	0.22	0.21	10.8
Haemmaglutinin (HIU/g)	58.24^a	49.15^b	17.24^c	6.35^d	0.02
Oxalate (mg/g)	0.25	0.20	0.13	0.12	0.03

a, b, c, d Means with different superscripts on the same row are significantly different (P>0.05).