POS -14

Minerals and Phytochemical Compositions of *Xanthosoma Mafafa* Tuber Meal Treated With Varying Levels of Palm Bunch Ash Solution

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Abstract
Varying concentrations of palm bunch ash solutions (0.00, 0.25, 0.50, 0.75 and 1.00 g/100ml water) were used to blanch cocoyam (*Xanthosoma mafafa*) tuber meal (XMTM) at 100°C for three minutes and its minerals and phytochemical compositionswere determined. The mineral composition results generally increased due to palm bunch ash solution treatment, with values increasing with increasing ash solution concentration as Potassium composition was found to be the most present mineral in the samples.The phytochemical composition values were reduced by the ash solution treatment ($p<0.05$). Tannin, phenol, and trypsin inhibitor values decreased with increasing ash solution treatment, while the reverse was the case for cyanide, alkaloids and phytate values. It was concluded that blanching with palm bunch ash solutions improves the mineralcomposition of XMTM and also reduced the phytochemical anti-nutrients present in XMTM and it is recommended to include the sample material for feed formulation by the Nigerian Institute of Animal Science (NIAS) as areplacement for maize.

Keywords: Cocoyam, *Xanthosoma mafafa,* tuber meal, minerals, phytochemical

Introduction

The tremendous increase in population and high demand for foodstuffs which cause anincrease in the cost of feeds and raw materials have led to a search for cheaperalternative sources for both man, animals,and industries.This research on effective exploitation of indigenous neglected food crops such as cocoyam (*Xanthosoma species*) might be a very effective, alternative and cheap energy identification effort for poultry feed formulation as well as raw materials for the production of industrial products such as starch (Onyeka, 2014). *Xanthosoma mafafa* which can be seen growing luxuriantly in waste dumpsites, compound bushes and along highways, especially in the southeastern part of Nigeria are usually weeded off due to their high rate of regeneration.Its use as food for man and animals has limiting factors such as the presence of anti-nutritional factors (ANF), which inhibit the activity of digestive enzymes thereby causing digestive losses (Hahn, 1984).

The anti- nutritional factors found in the tuber of *Xanthosoma species* include oxalates, phytates, tannins, saponins, phenols and trypsin inhibitors of which some serve defensive functions against pests and diseases of cocoyam and some may also serve as nutrient compounds (Smith, 1982). Effects of these anti-nutritional factors range from reduction of food and feed intake, depression of weight gain and pancreatic hypertrophy in animals (Paul *et al*., 1999).

Therefore this study determined the minerals and phytochemical composition of *Xanthosoma mafafa* tuber meal treated with varying levels of palm bunch ash solution**.**

Materials and Methods

The tubers of *X. mafafa* were gathered from the wild within Imo state, after identification at the Department of Crop Science Technology, Federal University of Technology Owerri. Ash derived from palm fruit bunch was used to prepare five ash solutions by mixing 0.00, 0.25, 0.50, 0.75 and 1.00 g ash to 100 ml of clean water and represented as samples A, B, C, D, and E respectively. Pulped *X. mafafa* tuber meal (XMTM) was produced by grinding the peeled and dried cocoyam. The XMTMs were then blanched by boiling them at 100°C for three minutes in the ash solutions and thereafter allowing them to cool before being removed and air dried until they caked. The XMTMs were analyzed in the laboratory for their minerals compositions with an atomic absorption spectrophotometer (AAS) bulk scientific model 210 VGB, to determine the following minerals: calcium (Ca), phosphorus (P), sodium (Na), potassium (K) and magnesium (Mg) and for theirphytochemical compositions according to the methods described bysofowora, (1980).

Data obtained from the study were subjected to analysis of variance (ANOVA) procedure (Steel and Torrie, 1980). Treatment means were separated using Duncan Multiple Range Test (Duncan, 1955).

Result and Discussion

The mineral composition results (Table 1) showed that Ca, Mg, K, P and Na concentrations of XMTM generally increased due to palm bunch ash solution treatment, with values increasing with increasing ash solution concentration. Potassium composition was found to be the most present mineral in the samples. This is due to the present of Potassium

carbonate (K_2CO_3) which is the main chemical composition of palm fruit bunch and was reported by Taiwo and Osinowo (2001) to make up about 43.15±0.13% of total elements in palm fruit bunch.

Table 1: Minerals composition of *Xanthosoma mafafa* tuber meal

Parameter (mg/kg)	A	B	C	D	E
Calcium	2345.00	2391.50	2391.66	2523.00	2750.00
Magnesium	2361.33	2017.00	2034.00	2052.00	2525.67
Potassium	11815.00	10650.67	14803.33	18090.00	26429.33
Phosphorus	783.67	661.00	957.33	1008.00	1320.00
Sodium	1246.00	1295.66	1455.00	1553.00	1646.66

A= 0.0% palm bunch ash solution; B= 0.25% palm bunch ash solution; C= 0.50% palm bunch ash solution; D= 0.75% palm bunch ash solution; E= 1.00 palm bunch ash solution

Table 2 shows that the phytochemical composition values were reduced by the ash solution treatment ($p<0.05$). Tannin, phenol, and trypsin inhibitor values decreased with increasing ash solution treatment, while the reverse was the case for cyanide, alkaloids and phytate values which increased with increasing ash solution treatment. Odedeji *et al*. (2014) reported that blanching had a significant reducing effect on the tannin content of feed materials thus making protein available for utilization in the material because tannins react with proteins thereby binding dietary proteins and digestive enzymes to form complexes which are not readily digestible.

Table2:The phytochemical compositionof*Xanthosoma mafafa* tuber meal

Parameters	A	B	C	D	E	SEM
Tannin	1066.1900^{a}	815.4667^{c}	770.0667^{d}	581.0500^{e}	877.1200^{b}	42.0159
Phenol	270.4900^{a}	245.3200^{d}	198.9783^{c}	175.7700^{d}	178.1468^{d}	10.11278
Cyanide	21.2767^{b}	12.6100^{e}	13.4667^{d}	14.3400^{c}	23.6567^{a}	1.20376
T. inhibitor	632.0167^{a}	424.600^{c}	386.4400^{d}	359.0567^{e}	450.6867^{b}	2566988
Alkaloids	1.9700^{b}	0.7900^{d}	1.8300^{c}	1.9767^{b}	2.4567^{a}	0.14717
Phytate	24.4650^{d}	24.9800^{d}	26.6667^{c}	27.3500^{b}	29.0767^{a}	0.44927

A= 0.0% palm bunch ash solution; B= 0.25% palm bunch ash solution; C= 0.50% palm bunch ash solution; D= 0.75% palm bunch ash solution; E= 1.00 palm bunch ash solution

Conclusion and Recommendation

It was concluded that blanching with palm bunch ash solutions improves the mineralcomposition of XMTM and also reduced the phytochemical anti-nutrients present in XMTM.At 0.75% treatment solution of palm fruit bunch ash,it showed better results in terms of reduction in the anti-nutritional factors present in the cocoyam pulp meal. At this concentration, blanched cocoyam pulp meal had lower tannin, trypsin inhibitor,and phenol levels. It is recommended to include the sample material for feed formulation by the Nigerian Institute of Animal Science (NIAS) as areplacement for maize. This will help reduce the overdependence on maize as anenergy source for poultry feed formulation and will, in turn, reduce the cost of poultry feed and thus boost the poultry industry.

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