

MON-62

Determination of Nutrients and Anti-Nutrients Composition of Four Varieties of Yam Peel Meal

A.H. Akinmutimi, A.S. Eburuaja, O.O. Adedokun, E.U. Ewa and E.U. Etim

College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike.P.M.B. 7267
Umuahia, Abia State.

Corresponding author: O.O Adedokun; Email: olubukolaadedokun@gmail.com. Telephone: 08063129194

ABSTRACT

The nutrients and anti-nutrients of four varieties of yam peel meals were investigated using the following parameters: proximate composition, mineral composition and some anti-nutrients (saponin, oxalate, trypsin inhibitor and tannin). The proximate result revealed significant differences ($P < 0.05$) for all parameters considered. The crude protein ranged from T1 (*Dioscorea dumentorum*) (11.43%) to T4 (*Dioscorea rotundata*) (12.44), making T4 the highest value for crude protein. Among the treatment means T4 had the highest values of all macro-minerals considered with Na 0.10%, K 0.89%, Ca 0.94%, P 0.27% and Mg 0.24%. Also for micro minerals T4 had significantly higher values of Mn 2.50%, Fe 75.40%, Zn 34.57 mg/kg and Cu 5.30 mg/kg. The least values for microminerals occurred in T3. T4 had the highest values of nutrients and T1 had the least except Trypsin inhibitors. Considering the appreciable values of crude protein (11.43%), least values of anti-nutrients and appreciable values of both micro and macro minerals, T1 (*Dioscorea dumentorum* peel meal) is recommended among other yam peel meal varieties as a potential alternative feedstuff especially for monogastric animals.

Keywords: Yam peel, varieties, anti-nutrients, nutrients, minerals

Introduction

Maize has been observed as the main cereal involved in animal nutrition, representing the main energy source and constituting about 60-70 percent of monogastric diets, especially pigs and poultry (Teguia *et al.*, 2007). Globally, maize is primarily used for animal feeds. In Africa however, maize is an essential food for human consumption in many homes. Agoda *et al.* (2011) noted that maize and other cereals account for about 70 percent of the total calories intake in most African countries. The trend of competition between humans and livestock particularly for grains has made it necessary to look inward for alternative energy sources that will replace maize or reduce its dependence since food security through sustainable agriculture is a necessity. Agro by-products have been reported to be an energy source in monogastric nutrition. One of the agro by-products that come to mind is yam peels. Iboro (2011) reported that there are various varieties of yam: they are *Dioscorea cayenensis*, *Dioscorea alata*, *Dioscorea dumentorum* and *Dioscorea rotundata*. Yam peels constitute about 10% of the whole tuber (Ebode, 2010).

Materials and Methods

The experiment was carried out at the poultry unit of the Research and Training Farm of the Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Peels from the following varieties of yam were collected in Umuahia and its environs. T1-Three-leaved yam (*Dioscorea dumentorum*), T2 - Water yam (*Dioscorea alata*), T3 - Yellow yam (*Dioscorea cayenensis*), T4 - White yam (*Dioscorea rotundata*). They were sundried, milled and used for chemical analysis. The proximate composition of various yam peel meals was determined using the procedure described by the Association of Official Analytical Chemists (AOAC, 2005). Mineral composition of the various yam peel meals was determined using the standard chemical method described by AOAC (2005). The following minerals were determined Na, K, Ca, Cu, Zn, Mg, Co, Se and Fe. The methods of Maga (1982), Lucas and Markaka (1975), Kakade *et al.*, (1969), Knowles and Montgomery (1980), Brunner (1985) and Murno (2000) were used to determine Tannic acid, phytic acid, trypsin inhibitors, hydrocyanic acid, saponin and oxalate content of the various yam peel meal respectively.

Results and Discussion

Table 1 shows the proximate composition of the four varieties of yam peels considered. There were significant differences in all the parameters considered except NFE. The crude protein content ranged from 11.43 (T1) to 12.44 (T4) percent which are higher than a conventional energy source, maize which has CP of 10%. This implies that using any of these varieties of yam peel meals in the formulation of ration will be an added advantage to the CP of the diet. T2 has the highest value of crude fiber, while T1 and T4 have similar values (4.80%). The range of values of crude fiber 4.74 to 4.84% is higher than that of maize which is 2%, nevertheless this may not be a problem for monogastric animals especially poultry as poultry can tolerate up to 5% level of inclusion of CF (Akinmutimi, 2004). The Ether Extract (EE) ranged from 3.57 (T1) to 3.66 (T2) which compares favourably with 4% of maize. This makes any of the varieties a potential energy source. The ash content ranges from 5.83(T2) to 6.34(T4) %. These low values of ash implied high values of TDN. The dry matter ranges from 90.08(T2) to 90.20(T3), these values are slightly higher than that of maize (88%). This suggests higher TDN values. From the fore-going T4 seems to be the choice treatment as regards proximate composition especially when CP, CF and DM are considered.

Table 1. Proximate composition of four varieties yam peel meals

Constituents%	T1	T2	T3	T4	SEM
CP	11.43 ^c	12.33 ^a	12.06 ^b	12.44 ^a	0.04
CF	4.80 ^b	4.84 ^a	4.74 ^c	4.80 ^b	0.00
EE	3.57 ^c	3.66 ^a	3.62 ^b	3.64 ^{ab}	0.00
DM	90.14 ^b	90.08 ^c	90.20 ^a	90.16 ^{ab}	0.02
NFE	64.0	63.51	63.78	64.61	93.31

^{a-d}Means treatments in a row with different superscripts are significantly different ($P < 0.05$). CP-crude protein, CF-crude fibre, EE-ether extract, DM-dry matter and NFE- nitrogen free extract

Table 2 reveals the values macrominerals in the four varieties of yam peel meals. There were significant differences in all the parameters considered. The values of sodium ranged from 0.80 (T2) to 1.00(T4) percent. Since salt is always part of poultry feed at about 0.25%, using any of these yam peel meals may reduce the quantity of salt added thereby reducing the cost of production. T4 has significantly ($P < 0.05$) higher values of Na, K, and Ca followed by T1 while T1 and T4 have the same values of P and Mg, this implies that using T1 and T4 to formulate ration will enhance carbohydrate metabolism, bone formation and blood clotting(Olomu 1995).

Table 2. Macro-minerals of four varieties of yam peel meal

Constituents (%)	T1	T2	T3	T4	SEM
Sodium(Na)	0.93 ^{ab}	0.80 ^c	0.87 ^b	1.00 ^a	0.00
Potassium(K)	0.88 ^b	0.78 ^d	0.81 ^c	0.89 ^a	0.67
Calcium(Ca)	0.93 ^b	0.89 ^c	0.89 ^c	0.94 ^a	0.96
Phosphorus(P)	0.27 ^a	0.26 ^b	0.26 ^b	0.27 ^a	0.00
Magnesium(Mg)	0.24 ^a	0.23 ^b	0.23 ^b	0.24 ^a	0.00

^{a-d}Means treatments in a row with different superscripts are significantly different ($P < 0.05$)

Table 3 reveals the micro-minerals of the four varieties yam peels considered in this study. As it is with the macro-minerals, T4 has significantly higher values of Mn, Fe, Zn and Cu followed by T1, T3 and T2. This suggests that using T4 to formulate poultry diets will enhance proper utilization of protein, carbohydrate and fats by the birds (Olomu 1995). From the foregoing T4 becomes choice treatment when micro-minerals and macro-minerals are considered.

Table 3. Micro minerals of four varieties of yam peel meal.

Constituents(mg/kg)	T1	T2	T3	T4	SEM
Manganese(Mn)	24.70 ^b	22.90 ^d	23.37 ^c	25.50 ^a	0.12
Iron(Fe)	74.60 ^b	73.50 ^d	74.00 ^c	75.40 ^a	0.06

Zinc(Zn)	33.80 ^b	32.67 ^d	33.00 ^c	34.57 ^a	0.09
Copper(Cu)	4.67 ^b	3.37 ^d	3.67 ^c	5.30 ^a	0.08

^{a-d}Means treatments in a row with different superscripts are significantly different ($P<0.05$).

The values of anti-nutritional factors in the four varieties of yam peels are shown in Table 4. T4 has highest values of saponin and tannins, T4 and T2 have the highest values of oxalate. This suggests that formulating ration with T4 may confer bitter taste on the diet and depression of performance of the birds (Eburuaja, 2010). High values of oxalate in T4 and T2 implies that feeding any one of them to birds at high values may result in irritation of the guts which will eventually lead to low feed intake (Akinmutimi, 2004). T1 has lowest values of oxalate and tannin. T1, T2 and T3 have the same but lowest values of saponin. T3 has a significantly high value of Trypsin Inhibitor while T4 has the lowest. Formulating diets with T3 implies that protein digestibility may be impaired and pancreatic hypertrophy may occur (Maynard *et al.*, 1979). In all T1 becomes the choice treatment when only anti-nutritional factors of the diets are considered.

Table 4. Anti-nutritional factors of four varieties of yam peel meal.

Constituents	T1	T2	T3	T4	SEM
Saponin(%)	0.12 ^b	0.12 ^b	0.12 ^b	0.13 ^a	0.00
Oxalate(%)	0.04 ^c	0.06 ^a	0.05 ^b	0.06 ^a	0.00
Tanni(%)	0.03 ^c	0.04 ^b	0.03 ^c	0.05 ^a	0.00
Trypsin inhibitor(Tiu/mg)	15.31 ^b	14.81 ^d	15.48 ^a	14.90 ^c	0.00

^{a-d}Means treatments in a row with different superscripts are significantly different ($P<0.05$).

Conclusion and Recommendation

Considering appreciable value of crude protein (11.43%) least values of anti-nutritional factors and appreciable values of macro and micro-nutrients, T1 (*Diocorea dumentorum* peel meal) is recommended among the other peel meals considered as a potential alternative feedstuff especially for monogastric animals.

REFERENCES

- AOAC (1990). Association of official analytical chemists. Official methods of analysis 5th ed. Washington DC.
- Akinmutimi, A H. (2004). Evaluation of sword bean (*Canavalia gladiate*) as an alternative feed resource for broiler chicks. Ph.D. Thesis, College of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike. pp 4-17.
- Akinmutimi, A.H. Abasiokong, S.F. and Shoyinka, V.O. (2006). Raw sword bean meal as a substitute for soybean meal in broiler finisher diets. *J. Anim.and Vet. Advances* 5(8):699-706.
- Agoda Samuel, Atanda Saburi, Usanga, D.E., Ikotun L. and Isong, L.U.(2011) Post-harvest food losses in maize production in Nigeria (Review) *Africans Journal of Agricultural Research*. 6(21):4833-4839.
- Brunner, J. R. (1985). Evaluation of haemagglutinating activity of low-temperature cooked kidney beans. *J. Fd. Sc.*, 50:78-81
- Eburuaja, A.S.; Chemical and nutritional evaluation of African yam bean as an alternative protein source in broiler diets. Ph.D Project, Michael Okpara University of Agriculture Umudike Abia State.
- Ebode, G.E. (2010). Growth performance of weaner rabbits fed graded levels of yam peel meal in place of maize in amaize-based diet. Undergraduate Project Report, Department of Animal Nutrition and Forage Science, College of Animal Science and Animal Production, Michael Okpara University Of Agriculture Umudike Abia State.
- Iboro, U.I. (2011) Performance of weaner pigs fed graded levels of yam and sweet potato peel meal in place of maize in a maize-based diet. B. Agric. Project Report, Michael Okpara University of Agriculture Umudike Abia State.
- Kakade, M.I., Rachis, J.J., Meghee, J.E. and Puski (1969). Determination of trypsin inhibitor activity of soy products. A collaboration analysis of improved procedure. *Cereal Chem.* 151-371.

- Knowles, W. and Montgomer, R. D. (1990). Toxic constituents of plant foodstuff 2nd ed. Academic Press, New York. Pp. 10-15.
- Lukas, G.M and Markaka, P (1975). Phytic acid and other phosphors compounds of beans (*Phaseolus vulgaris*) J. Agric. Ed. Chem. 23 (1): 13-15.
- Maga, L. A. (1982). Phytate. Its chemistry occurrence, Food interaction nutritional significance and method of Analysis. J. Agric. Food Chem. 30:1.
- Maynard, L. A., Loosli, J.K. Hintz, H.F. and Warner, R.G. (1979). Animal Nutrition (7th edition). Tata mc Graw –Hill PU. Co Ltd, New Delhi, India Pp 20-27.
- Murno, A.B. (2000). Oxalate in Nigerian Vegetables. W.A.J. boil.App.Chem 23:13-15
- Olomu, J. M. (1995). Monogastric Animal Nutrition Principles and practice (1st Ed.). A Jachen publication, Benin City, Nigeria 320 Pp
- Teguia,A.,Telefo, P.B. and Fosto, R.G. (2007). Growth performance, organ development and blood parameters of rats fed graded levels of steeped and coned taro tubers (*Colocasia esculenta*) meal. Livestock Research for Rural Development. 19(6).