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Potentials of sweet potato foliage as feed ingredient in Broiler diets

***Okereke, C. O., Okereke, I. H., Olaleru, I. F. and Ukonu, C. E.**

National Root Crops Research Institute, Umudike
Corresponding author's email: *ogbokereke2009@yahoo.com

Abstract
A total of one hundred and twenty (120) day-old broiler chickens were used in a feeding trial to determining the potentials of sweet potato foliage-based meals as supplement in broiler chickens production. Four iso-nitrogenous (20%) diets containing 2914.45, 2882.23, 2851.38 and 2782.60 Kcal/kg ME was used respectively for the study in a complete randomized design (CRD). Feed and water were provided to the chickens *ad libitum* for eight weeks. The results of the proximate composition of sweet potato foliage meal revealed that moisture (9.15%), dry matter (90.85%), ash (7.35%), crude fiber (22.52%), fat (2.47%), crude protein (18.82%) and NFE (39.70%). The growth performance result for final body weight and weight gain followed the same pattern. Diet I was significantly different ($P<0.05$) from diets II, III and IV but diet II and III were similar ($P>0.05$) and differ from diet IV. Total feed intake and average feed intake/bird/day followed the same trend. Diets I, II and III were significantly different ($P<0.05$) from diet IV. The cost of feed/kg (N) decreased with increasing dietary levels of sweet potato foliage meal. The result of carcass characteristics showed that there were no significant differences ($P<0.05$) in % dressing weight, breast (%), wing (%) and back cut (%). Live weight, de-feathered weight, dressed weight, drumstick (%) and thigh (%) followed similar trend, broilers fed diets I, II and III were significant better than those fed diet IV. Organs such as heart, kidney, small intestine and large intestine showed no significant differences ($P<0.05$). The sweet potato foliage meal included up to 10% was tolerated by the broiler chicken in all the parameters evaluated with an average initial weight of 90g.

Keywords: Sweet potato foliage, growth, carcass and organ weight, haemotological and Serum chemistry

Introduction

Sweet potato is cultivated for food in more than 100 countries, as a staple food. Because of its fast or short growing period, low input and work requirements, sweet potato is often planted as a security crop or famine prevention crop (Scott *et al.*, 1993). While the tubers are the main agricultural product derived from the sweet potato crop, the vegetative parts are a very valuable feed for livestock. Sweet potato vines and foliage can be fed to cattle, sheep, goats, pigs and rabbits. It may be fed fresh, dried or ensiled, and makes very palatable silage with a pleasant fruity smell (Lebot, 2009). Sweet potato forage can also be dried, ground and mixed with sugarcane by-products. In tropical areas sweet potato vines are one of the promising protein sources for pigs. Sweet potato leaves have high content of protein ranges from 24-29% CP (Nguyen Thi Thuy and Ogle, 2004). The competition between human and animals for the same energy and protein sources is a source of wary to animal nutritionist. The poultry farmers are facing major challenges such as high costs and shortage of feed stuffs mainly the energy and protein sources like maize, soya bean meal and fish meal. These challenges will, however, be overcome by using leaf meal such as sweet potatoes leaf meal as energy and/or protein source in broiler diets. The study was aimed at determining the proximate composition, growth performance, carcass characteristics and organ weight, haemotological and Serum chemistry parameters of the broilers fed new sweet potato foliage meal.

Materials and Methods

Experimental Site

The research work was carried out at the National Root Crops Research Institute poultry farm located at Umudike, Abia State. Umudike lies on latitude 05°29'N and longitude 07°33'E with an elevation of 122m above sea level and is located in the tropical rainfall forest of Nigeria. This zone is characterized by annual rainfall of about 2177mm, with monthly ambient temperature range of 22°C – 36°C and relative humidity of 50 – 95% depending on the season and location (NRCRI, 2018).

Processing of the Experimental Material
The sweet potato (Umuspo 4 or Solo Gold) foliage used in the research was obtained from NRCRI Sweet Potato Programme and Farming Systems Research Programme and was cut, chopped, sun dried for four days and milled (hammer mill).

Proximate Compositions and Gross Energy of Sweet potato Foliage
Samples of the test materials were analyzed for, their proximate constituents according to the methods described by AOAC (2005) while the gross energy was determined using Adiabatic Oxygen Bomb Calorimetric technique.

Experimental birds and design
One hundred and twenty (120) day old Abor Acre plus strains of broiler chickens were purchased from Agrited farms for the experiment. The day-old broilers were divided into four groups of thirty birds each. The groups were randomly allotted to four dietary treatments, in three replicates of ten birds per replicate in a Completely Randomized Design (CRD). The chicks were fed broiler starter diets for a period of four weeks thereafter finisher broiler diets were introduced for another four weeks. The chicks were brooded and reared on a deep litter system in an open-sided poultry house whose sides and demarcations between pens were covered with black tarpaulin hanging from the outside, each of the deep litter pen measured 62 x 68cm. Heat was supplied with kerosene stoves. Standard management practices were followed during the brooding stage. Feed and water were provided to the chicks *ad libitum*. The chicks were vaccinated against Newcastle and Gumboro diseases, Antibiotics, coccidiostat and anti-stress were also given to the chicks. The litter material was wood shavings and experiment lasted 8 weeks.

Experimental diets
Four diets were formulated for this trial, the processed sweet potato foliage meals were respectively used to formulate 3 different (II, III and IV) diets. Diet I is the control diet having maize as the major energy source. Diets II, III and IV had 5, 10 and 15% of maize respectively substituted with sweet potato foliage meals. The percentage compositions of the diets are presented in Table1.

Statistical analysis
All data obtained was subjected to one-way Analysis of Variance (ANOVA) procedure according to the method of SPSS and differences in mean were separated using Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion
The results of the proximate composition of sweet potato foliage meal reveal moisture content of 9.15%, dry matter 90.85%, ash 7.35%, crude fiber 22.52%, fat 2.47%, crude protein 18.82% and NFE 39.70%. The crude protein and crude fiber content of sweet potato foliage meal is higher than that in maize which is the standard conventional energy source in poultry diet. The growth performance result for final body weight and weight gain followed the same pattern. Diet I was significantly different from Diet II, III and IV but diet II and IV are similar and differ from diet III. Total feed intake and average feed intake/bird/day followed the same trend. Diet I, II and III were significantly different from Diet IV. The result reveals that feed intake and weight gain increased up to diet III (10% sweet potato foliage meal) and later dropped. This may not be unconnected to crude fiber of the diet IV as shown in Table I. The cost of feed/kg (N) decreased with increase in dietary sweet potato foliage meal. The result of carcass characteristics (Table 3) showed that there were no significant differences ($P<0.05$) in % dressing weight, breast (%), wing (%) and back cut (%). The implication of these result is that those parameters measured were not significantly ($P<0.05$) influenced by the dietary levels of sweet potato foliage meal. Live weight, de-feathered weight, dressed weight, drumstick (%) and thigh (%) followed similar trend, broilers fed diets I, II and III were significant and better than those fed diet IV. Organs such as heart, kidney, small intestine and large intestine showed no significant differences ($P<0.05$), which implies that diets at the present levels could not produce any significant effect.

Heamatological parameters
Packed cell volume (PCV), haemoglobin (HB) and red blood cells (RBC) showed no significant ($P<0.05$) difference and within the normal range. White blood cells (WBC) showed significant differences with diet IV (Table 4) having the highest value. The number of leukocytes in the blood is often an indicator of disease and thus the WBC count is an important subset of the complete blood count: they make up approximately 1% of the total blood volume in a healthy adult; this 1% of the blood makes a large difference to health, because immunity depends on it (Bruce *et al*., 2002). An increase in the number of leukocytes over the upper limits is called leukocytosis. A decrease below the lower limit is called leukopenia which weakens the immune system.

Serum chemistry parameter
Glucose showed no significant ($P<0.05$) difference, but albumin, serum total protein and globulins showed significant differences, still within the normal range for a healthy bird (Mitruka and Rawnsely, 1977).

Conclusion
The sweet potato foliage meal included up to 10% was tolerated by the broiler chicken in all the parameters evaluated and we therefore recommend that Umuspo 4 foliage be used by farmers up to 10% in the diet of finisher broiler chickens.

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Table 1: Percentage Composition of broiler chicken diets containing graded levels of sweet potato foliage meal

Ingredients	Diet I (0%)	Diet II (5%)	Diet III (10%)	Diet IV (15%)
Yellow Maize	55.96	53.16	50.36	47.57
Sweet Potato Foliage Meal	-	2.80	5.60	8.39
Soya bean meal	26.34	26.34	26.34	26.34
Wheat offal	12.00	12.00	12.00	12.00
Fishmeal	2.00	2.00	2.00	2.00
Bone Meal	3.00	3.00	3.00	3.00
*Vitamin premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100	100	100	100
CP%	20.00	20.25	20.49	20.76
CF%	3.87	4.44	5.02	5.59
ME.Kcal/kg	2914.45	2882.23	2851.38	2782.60

**** Vitamin Mineral Premix supplied per kg diet: vitamin A 15,000 I.U, vitamin D3 13000 iu, thiamin 2mg, Riboflavin 6mg, pyridoxine 4mg, Niacin 40mg, cobalamine 0.05g, Biotin 0.08mg, choline chloride 0.05g, Manganese 0.096g, Zinc 0.06g, Iron 0.024g, Copper 0.006g, Iodine 0.014g, Selenium 0.24mg, Cobalt 0.024mg and Antioxidant 0.125g.***

Table 2: Growth performances of broilers chicken fed diets containing graded levels of sweet potato foliage meal

Parameter	Diet I (0%)	Diet II (5%)	Diet III (10%)	Diet IV (15%)	SEM
Initial Body weight	90.00	90.00	90.00	90.00	0.00
Final Body weight	1913.33^{a}	1646.67^{b}	1580.00^{c}	1623.33^{b}	75.44
Weight gain	1823.33^{a}	1556.67^{b}	1490.00^{c}	1533.33^{b}	115.26
Total feed intake	4288.00^{a}	4171.00^{a}	4173.67^{a}	3786.33^{b}	109.59
Average Wt gain/bird/day	32.56^{a}	27.80^{b}	26.61^{b}	22.56^{b}	2.06
Average Feed Intake/bird/day	76.57^{a}	74.48^{a}	74.53^{a}	67.62^{b}	1.95
FCR	2.36^{c}	2.68^{b}	2.80^{b}	2.99^{a}	0.13
Cost of feed/kg (₦)	131.40	129.16	126.92	123.29	-

^{abc} Means along the same row with different superscripts are significantly (P<0.05) different.
SEM: Standard error of mean

Table 3: Carcass characteristics and Organ Proportion of broilers chicken fed diets containing graded levels of sweet potato foliage meal

Parameter	Diet I (0%)	Diet II (5%)	Diet III (10%)	Diet IV (15%)	SEM
Live weight	1833.33[a]	1683.33[a]	1683.33[a]	1450.00[b]	79.17
De-feathered weight	1616.67[a]	1566.67[a]	1583.33[a]	1333.33[b]	64.73
Dressed Weight	1226.33[a]	1111.67[a]	1079.00[ab]	927.67[b]	61.56
% Dressing Wt	66.89	66.07	64.05	63.92	0.74
Breast (%)	31.54	31.76	29.41	29.13	0.69
Drumstick (%)	15.44[b]	16.58[ab]	17.22[a]	15.21[b]	0.48
Thigh (%)	15.76[ab]	15.25[b]	16.19[ab]	16.95[a]	0.36
Wing (%)	12.96	12.84	12.70	12.62	0.08
Back cut (%)	21.57	20.54	20.86	21.22	0.22
Heart %	0.38	0.35	0.36	0.39	0.01
Kidney %	0.55	0.63	0.53	0.62	0.02
Small Intestine%	3.06	3.58	3.42	3.19	0.12
Large Intestine %	0.51	0.77	0.66	0.60	0.05

[abc] Means along the same row with different superscripts are significantly (P<0.05) different.
SEM: Standard error of mean

Table 4: Heamatological and Serum chemistry parameter of broilers chicken fed diets containing graded levels of sweet potato foliage meal

Parameter	Diet I (0%)	Diet II (5%)	Diet III (10%)	Diet IV (15%)	SEM
PCV	27.33	31.00	28.33	32.00	1.09
HB(g/dl)	12.70	13.27	12.67	13.27	0.17
RBC	3.14	3.55	3.25	3.69	0.13
WBC	38.27[b]	35.27[b]	35.20[b]	44.90[a]	2.28
Glucose (mg/dl)	178.00	171.00	168.00	182.67	3.33
Albumin(g/dl)	1.94[bc]	1.83[c]	2.14[ab]	2.30[a]	0.10
Total Protein(g/dl)	3.87[b]	3.59[b]	3.99[ab]	4.34[a]	0.16
Globulin(g/dl)	1.93[ab]	1.76[b]	1.85[ab]	2.04[a]	0.06

[ab] Means along the same row with different superscripts are significantly (P<0.05) different.
SEM: Standard error of mean