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Research Paper

The Nutritive Value and Evaluation of Sweet Potato (*Ipomoea Batatas*) Leaf Meal on the Growth Performance of Broiler Chickens

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Abstract: *A total of 60 Russ 2011 two weeks old broiler chicks with an average weight of 215.33±4.55g were fed with diets compounded with sweet potato leaves (SPL) for 56 days. The diets consist of T_1 (0% SPL), T_2 (5% SPL), T_3 (10% SPL) and T_4 (15% SPL). The proximate composition of the SPL was determined in the laboratory. The birds were randomly allocated to four treatments using completely randomized design (CRD). Each treatment was subdivided into three replicates of five chicks each. At the end of the experiment, all data collected were subjected to one way analysis of variance and difference in means was separated using Duncan's New Multiple Range Test. The results showed that SPL contains 4.07%, 24.21%, 7.74%, 3.88%, 11.05% and 49.05% of moisture, crude protein, crude fibre, crude fat, ash and nitrogen free extract respectively. There was no significant difference ($P>0.05$) in the average body weight gain, feed intake, feed conversion ratio (FCR) and protein efficiency ratio (PER). However, birds on T_2 (32.77g) had the best daily body weight gain followed by T_4 (30.36g), T_3 (30.06g) and T_1 (29.21g) while in terms of daily feed intake, T_4 (98.20g) consumed most followed by T_2 (98.17g) and T_3 (96.59g) whereas, T_1 (92.38g) consumed the least feed. The birds on T_2 (3.00) demonstrated the best FCR followed by T_1 (3.16), T3 (3.21) and T_4 (3.23). Also T_1 (1.59) showed the best PER closely followed by T_1 (1.53), T_3 (1.46) and T_4 (1.43). It is therefore recommended that inclusion of SPL up to 5% in the diet of broilers is good for enhanced body weight gain, FCR and PER.*

Keywords: Broilers, growth performance, nutritive value, sweet potato leaf.

Introduction:

Vegetables serve as an indispensable constituent of the human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy (Oyenuga and Fetuga, 1975). However, there are some used and inexpensive leafy vegetables whose nutritive and anti-nutritive potentials are yet to be adequately studied and utilized (Antia *et al.*, 2006). In the same vein, they are leaves that have less use by humans and animals possibly because their nutritive and anti-nutritive values have not been studied. They are allowed to waste and sometimes constitute health hazard through the stench that exude from their decomposing heaps, as well as serving as unending source of pathogenic organisms to animals and humans.The principal material problem facing the poultry industry today, particularly the broiler production, remains the high costs of poultry feeds resulting from the soaring costs of grains (Mmerole, 1996; Mmerole, 2008) that supply energy and protein. The grains are known to constitute 60-70% of the poultry feeds (Ekenyem, 2007). The high costs of grains are due to the competition for grains between livestock feeds and other large scale demands such as for human consumption and industrial uses as in the case of breweries and confectionaries (Mmerole, 2009). Sweet potato leaves (SPL) are occasionally used as vegetables in yam and cocoyam porridges in some parts of Nigeria particularly among the Efik-Ibibio people of South-Eastern Nigeria (Eka and Edijala, 1972). Besides being used for human consumption, the leaves serve as fodder for cattle, sheep, goats, pigs and other domestic animals (Antia *et al.*, 2006). For the fact that some of these leaves with high nutritional composition are allowedto waste, thereis need to utilize them in poultry and other domestic animal's feeds to help reduce cost of feed and by extension that of production. Many studies have been conducted using various leaf meals as protein sources such as cassava leaf meal (Ng and Wee, 1989), alfalfa (Yousif *et al*., 1994), *Carica papaya* and other leaf meals (Reyes and Fermin, 2003), *Leucaena leucocephala*leaf meal (Bairagi *et al*., 2004) and sweet potato leaf meal (Adewolu, 2008; Wude and Berhan, 2009; Antia *et al*., 2006; Mmerole, 2009).

In the past decades, studies have been carried out to identify alternative and non-conventional feed resources which are cheap and easily available for poultry production (Aduku, 1993; Esonu *et al*., 2003; Ekenyem, 2007; Mmerole, 2009). Sweet potato (*Ipomoea batatas*) belongs to the morning-glory family:- convolvulaceae. It is cultivated in over 100 nations and ranks fifth among the most important food crops in the tropical areas (An, 2004). The leaves of this plant have been used in the tropics as cheap protein sources in ruminant feeds (Adewolu, 2008). Studies have been conducted to determine the nutritive value of SPL. According to Woolfe (1992), Teguia *et al.* (1997), Ishida *et al.* (2000), An (2004), Nguyen and Ogle (2004) and Ekenyem and Madubuike (2006), the leaf meal has a high crude protein content of between 24-33%, with high amino acid content with good mineral profile and vitamins A, B, C and E. Apart from its nutritive value, SPL can be harvested many times throughout the year (Hong *et al*., 2003). One major factor limiting the use of this leaf meal is the presence of anti-nutritional factors (Tacon, 1993) which according to Oyenuga (1968) are the invertase and protease inhibitors and by Antia *et al*. (2006) are cyanide, tannins, oxalate and phytate. However, these substances can be inactivated by various processing methods such as oven or sun-drying, boiling or steaming and grinding prior to inclusion in the feed (Adewolu, 2008). Also the leaves are deficient in an essential amino acid:- lysine, necessitating the inclusion of adequate lysine in poultry diets (Fuller and Chambellain, 1982).

Since there are scanty information on the growth performance effect of this leaf on broiler considering its relatively high crude protein content and in contrast, some anti-nutritional factors, there is need to evaluate the growth performance of broilers on the leaf meal to ascertain its efficacy or otherwise.

Materials and Methods:

Experimental Site, Diets, Proximate Analysis and Processing of Sweet Potato Leaves

The experiment was conducted at the poultry pen of The Research Farm of the Department of Animal Science, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria. The sweet potato leaves (SPL) were bought from Eke Imoha, Onueke, Ezza-South LGA of Ebonyi State. The leaves were destalked, washed and sun-dried to constant weight for 3-5 days on a plastic sheet laid on concrete floor. Part of the leaves was ground to fine powder using mortar and pestle and sent to the laboratory of Food Science Technology of the same University for proximate composition analysis (AOAC, 1990). The remaining leaves were milled and mixed with other ingredients to compound the feeds.

Experimental Birds, Design and Management

A total of sixty RUSS 2011 broiler chicks aged 2 weeks with average weight of 215.33±4.55g were used for the research. The birds were randomly allocated to four treatments using completely randomized design (CRD). Each treatment was subdivided into three replicates of five chicks each, making a total of 12 replicates and sixty birds. The poultry house was cleaned and washed with disinfectant solution, allowed un-stocked for two week. The poultry equipments were also cleaned and disinfected. Wood shavings were poured on the floor two days before the arrival of the chicks. On arrival, clean water with glucose and vitalyte was served them as anti-stress. The initial weights were taken and recorded on arrival and sources of heat put on in the brooder house. They were fed twice daily, in the morning by 7am and evening by 5.30pm. all vaccination scheduled were observed, the litter materials were replaced after the brooding stage and the sanitary/biosecurity was also maintained. They were dewormed using levamisol solution, given multivitamins during stress periods like vaccinate and as well were given coccidiostat (Embazin forte^{R}). The experiment lasted for 8 weeks.

Data Collection and Statistical Analysis

Weekly Weight Gain: This was collected weekly through weigh back mechanism.

Feed Intake: The daily feed intake was got through weigh back mechanism too.

Feed Conversion Ratio: This was obtaining by dividing the average total feed intake by average total weight gain.

All the data were subjected to one way analysis of variance and statistical difference in means was separated using New Duncan's Multiple Range Test (Obi, 2002).

Table 1: Composition of the experimental starter diets

Ingredients (%)	T1	T2	T3	T4
SPL	0	5	10	15
Maize	45	45	45	45
GNC	25	25	25	25
PKC	21	16	11	06
Fish meal	3	3	3	3
Wheat offal	2	2	2	2
Lime stone	0.9	0.9	0.9	0.9
Bone meal	2	2	2	2

Lysine	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Broiler premix	0.25	0.25	0.25	0.25
Mycofix	0.10	0.10	0.10	0.10
Salt	0.30	0.30	0.30	0.30
Total	100	100	100	100
Crude protein (%)	21.56	21.91	22.23	22.61
ME (kcal/kg)	2731.80	2760.40	2789.01	2817.65

Table 2: Composition of the experimental finisher diets

Ingredients (%)	T1	T2	T3	T4
SPL	0	5	10	15
Maize	45	45	45	45
GNC	18.10	18.10	18.10	18.10
PKC	25	20	15	10
Fish meal	3	3	3	3
Wheat offal	5	5	5	5
Lime stone	0.8	0.8	0.8	0.8
Bone meal	2	2	2	2
Lysine	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Broiler premix	0.25	0.25	0.25	0.25
Mycofix	0.10	0.10	0.10	0.10
Salt	0.30	0.30	0.30	0.30
Total	100	100	100	100
Crude protein (%)	19.72	20.07	20.42	20.77
ME (kcal/kg)	2633.60	2662.24	2690.84	2719.44

Key: SPL = Sweet potato leaf
GNC= Groundnut cake
PKC = Palm kenel cake
ME = Metabolisable energy

Results and Discussion:

The result of proximate analysis of sweet potato leaf (SPL) is presented in table 3. The values for moisture, crude protein, crude fibre, crude fat, ash and nitrogen free extract (NFE) were 4.07%, 24.21%, 7.74%, 3.88%, 11.05% and 49.05% respectively while the dry matter and metabolisable energy (ME) were 81.78% and 2668.36kcal/kg respectively. These values were lower than the values reported by Woolfe (1992), An (2004), Etuk *et al*. (1998), Akindahunsi and Salawu (2005) and Hoang *et al*. (2003) for SPL but closely similar to the values reported by Teguia *et al*. (1997) Antia et al. (2006), Adewolu (2008) and Wude and Berhan (2009).

Table 4 shows the performance characteristics of broiler birds fed diet compounded with 0%, 5%, 10% and 15% of SPL. There was no significant difference ($P>0.05$) in the average initial body weights among T1 (210.67g), T2 (221.33g), T3 (213.33g) and T4 (216.00g) treatments. There was however a significant difference ($P<0.05$) when the average final body weight of birds in T1

(1846.67g) was compared to T2 (2056.67g), T3 (1896.67g) and T4 (1916.67g) but no significant difference (P>0.05) when T2, T3 and T4 were compared. The average total body weight gain of T1 (1636g), T2 (1835.34g), T3 (1683.34g) and T4 (1700.67g) were however not statistically different(P>0.05) when compared. This study contradicts the findings of Teguia *et al*. (1993) and Wude and Berhan (2009) who reported statistically lower body weight gain beyond 10% inclusion of SPL but it is in tandem with the results of Amha (1990) and Adewolu (2008) who reported that birds assigned to 5%, 10% and 15% dried SPL diets gained approximately similar body weights as in this experiment. This trend of gradual increase in average body weight gain as the SPL increased could be due to some growth promoting principles in the leaf. This can be corroborated by the fact that the previous works of Woolfe (1992), Teguia *et al*. (1997), Ali *et al*. (1999), Ishida *et al*. (2000), An (2004), Nguyen and Ogle (2004) and Ekenyem and Madubuike (2006) on SPL meal revealed high crude protein content of between 24-33%, high amino acid content, good mineral profile and vitamins A, B, C and E. Although the leaf contains anti-nutritional factors (Tacon, 1993) like invertase and protease inhibitors (Oyenuga, 1968), cyanide, tannins, oxalate and phytate (Antia *et al*., 2006), they can be inactivated by various processing methods like sun-drying, boiling and grinding prior to inclusion (Adewolu, 2008). The average total feed intake of T_1 (5173.16g), T_2 (5497.34g), T_3 (5403.82g) and T_4 (5499.43g) showed a significant difference (P<0.05) when T_1 was compared to other treatments but not so (P>0.05) when T_2, T_3, and T_4 were compared. The high feed intake could be due to the anti-nutritional components of SPL which probably bound the nutrients and made them unavailable to absorption no wonder they ate more to meet their energy requirements (Hill and Danskey, 1954; Sahlotaut, 1987; Blaxter, 1989; Coop and Kyriazakis, 2001; Unigwe, 2011). This also gives credence to the fact that the feed even at 15% inclusion of SPL was palatable enough to the birds. This might be due to the processing technique (drying and grinding) employed in this study. This might have reduced the anti-nutrients in SPL as well increased its palatability to the birds. This is in conformity with the findings of Fagbenro (1999), Francis *et al*. (2001) and Siddhuraju and Becker (2003) who found that reduction in anti-nutrients by different processing techniques resulted in better palatability and growth in fish.

Although the nutritional quality of SPL as elucidated by daily body weight gains, FCR and protein efficiency ratio of broilers was highest in T_2 (5% SPL), there was no significant difference (P>0.05) among other treatments. This could be due to lower anti-nutrients T_2 diet compared to those of T_3 and T_4. It is also most probable that due to its higher metabolisable energy and crude protein content compared to the T_1 (0% SPL), it did better relatively. This agrees with the findings of Grimmes *et al*. (1997) and Okonkwo *et al*. (1995) that as the level of the fibrous ingredient such as SPL increases in the broiler diet, the growth performance characteristics start to decline. It also exonerates the work of Farrell *et al*. (2000) who reported no significant difference (P>0.05) in FCR by broilers fed 0, 4, 8, 12 and 16% sweet potato vine. Also corroborates Teguia *et al*. (1993) who included dried SPL up to 20% without any detrimental effect on body weight gain and FCR. But for the fact that there were no significant difference (P>0.05) among these performance characteristics, it agrees with Okoye (2001) who observed no inferior performance of broilers fed cassava leaf meal when compared to those fed 100% maize diets so long as the inclusion does not exceed 10%, beyond which performance traits start to decline.

Table 3: Proximate chemical composition of sweet potato leaf

Nutrient	Composition (%)
Moisture	4.07
Crude protein	24.21
Crude fibre	7.74
Crude fat	3.88
Ash	11.05
Nitrogen free extract	49.05
Dry matter	81.78
Metabolisable energy (kca/kg)	2668.36

Table 4: Growth performance characteristics of broilers fed sweet potato leaves diet

Parameter	**T1**	**T2**	**T3**	**T4**	**SEM**
Av. initial bwt (g)	210.67	221.33	213.33	216	7.42
Av. final bwt (g)	1846.67[b]	2056.67[a]	1896.67[a]	1916.67[a]	85.40
Av. total bwt gain (g)	1636	1835.34	1683.34	1700.67	85.14
Av. daily bwt gain (g)	29.21	32.77	30.06	30.36	1.46
Av. total feed intake (g)	5173.16[b]	5487.34[a]	5403.82[a]	5499.43[a]	160.06
Av. daily feed intake (g)	92.38[b]	98.17[a]	96.50[a]	98.20[a]	2.83
Feed conversion ratio (FCR)	3.16	3.00	3.21	3.23	0.12
Protein efficiency ratio (PER)	1.53	1.59	1.46	1.43	0.11

abc: means on the same row with different superscripts are significantly different ($P<0.05$)

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