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Growth Performance of Broiler Chickens Fed Diets Containing Partially Cooked Sweet Potato Meal

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Abstract
A feeding trial was conducted to investigate the effect of partially cooked sweet potato meal on the performance of broiler chikens. A total of two hundred 8 day-old Anak 2000 strain broiler chicks were used. Partially cooked sweet potato meal (PCSPM) was included at 0, 20, 40, 60 and 80% levels designated as diets; I, II, III, IV and V respectively. The broiler chicks after brooding were randomly allotted to the five dietary tratments, each replicated four times with ten chicks per replicate in a completely ramdomised design. The feeding trial lasted for a period of eight weeks. Feed and water were provided at *ad libitum*. The results showed that daily weight gain was highly significantly ($P<0.01$) affected by dietary treatments. Such that any increase in the proportion of PCSPM in the starter diet negatively influenced weight gain. Feed conversion ratio was also highly significantly ($P<0.01$) affected, however, FCR increases with increase in the proportion of PCSPM. In the finisher phase, there is significant ($P<0.0$) difference in daily weight gain and feed conversion ratio. In the pooled performance, daily feed intake was significantly ($P<0.05$) influenced by dietary treatments. There is however no difference in feed consumption between the birds fed diet V (80% PCSPM) and those on control diet (0% PCSPM). It can be concluded that, PCSPM can be fed to broiler chickens at up to 80% level with a promising groth performance

Keyword: Growth, Partially cooked, Performance, sweet potato

Introduction

Cereals generally make up between fifty-five and eighty-five percent of most conventional compounded animals feeds, where they supply a major part of the nutrients provided. From these; it is possible to see that cereals used at the levels indicated above, will provide not only the main part of the energy in feeds, but also a significant part of the total protein, together with minerals and vitamins. Proteins and essential fatty acids are generally supplied from oilseed cakes and meals and animal and fish protein products, many of which originate from the regions of the world in which most developing nations are located. Developing countries are in fact net exporters of these materials. Considering the above points, it would appear that replacement of this cereal component of feeds is likely to offer a beneficial first step towards alleviating animal feed supply problems. The second step is to increase the supply of feedstuffs so that animal production can be increased and greater amount of meat and livestock products made available to all. The plant materials identified for particular consideration in this study to replace maize is sweet potato roots. A close comparison of the compositions of maize and the substitutes being considered here produces the following conclusions: that,

- On the basis of their compositions alone, the substitutes would appear to have considerable potential to provide a considerable amount of the nutrient at present provided by maize in animal feeds.

- The low protein content of the possible alternatives could be compensated for by better utilization of locally produced protein sources, or the use of proteinaceous agro-industrial by-products, *azolla*, soymilk residue etc.

Sweet potatoes are mostly grown in developing countries that accounted for over 98 percent of world output with China alone producing about three quarter of the total. Even though, this is not the case today due to increasing land diversion to industrial development and for cereal production. However, production rose by an overall 13 percent in Africa in the late eighties. The constraints to the expansion of sweet potato production vary from country to country. In many producing areas, yields have failed to improve due to varietal degeneration and there appear to be few incentives to use agricultural chemicals on sweet potatoes. On utilization, world food consumption of sweet potato is estimated to account for over 50% of supply while 30% percent is estimated to be feed, while the reminder used as planting material, processed or wasted. Feed use in China is thought to be of the order of 20 percent of availability, a proportion that falls to 16 percent for developing countries as a whole. In Africa, however, only 3 percent of supply is estimated to be feed and over 20 percent wasted. These indicate the existence of some potential in this region for large on-farm use as feed if waste could be cut. It is against this background that this study was design to evaluate the performance attribute (feed intake, weight gain and feed conversion ratio) of broilers chickens and also to assess the economic of broiler production fed partially cooked sweet potato meal based diets.

2.0 Material and Method

2.1 Plan of the experiment

The experiment was conducted at the poultry unit of the Teaching and Research Farm of the Abubakar Tafawa Balewa University Bauchi. Fresh sweet potato obtained from farmers in Toro were sorted and placed in open drum and put on fire after adding water. The sweet potato was partially cooked for forty five minutes after which, it was chopped to facilitate drying. The chopped sweet potato was sun dried for three days. It was then milled and used during feed mixing. Two hundred 8day-old Anak 2000 strain broiler chicks with an initial weight of 1460g were randomly allotted to five dietary treatments. There were forty (40) chicks per treatment which was replicated four times, that is ten chicks per replicate in a completely randomized design. The partially cooked sweet potato meal used in this experiment was included at 0, 20, 40, 60 and 80% levels. The diets were formulated to meet the 23% and 20% crude protein requirements of broiler chickens for starter and finisher phases respectively. The ingredient and nutrient compositions of the diets are presented in Tables 1 and 2.

2.2 Experimental birds and their management

Prior to the arrival of the day-old chicks, the brooding room and pens were thoroughly cleaned, washed and disinfected using detergent, Z-Germicide and the opened sides of the pens were covered with used empty cement bags. The brooder and pens were fumigated using 35g of potassium permanganate crystal and 2mls of 40% formaldehyde solution (per pen) which produced formalin gas that killed all the germs and pathogens in the rooms. The rooms were locked for three days. All equipment including feeding trays, feeding troughs, drinkers, brooding guard and canopies were also disinfected.

Three days to the arrival of the chicks, fresh, dried and cleaned wood shavings were spread in each pen and

used as litter material. Ceiling boards were used as brooder guard in the brooder, and heat was provided in the daytime by the 200 watt bulbs placed in strategic points in the brooder, however, heat from burnt charcoal was used together with bulbs to provide heat during cool nights, light was provided in the absence of power by two big hurricane lanterns.

On arrival the day-old-chicks were counted and placed on the litter material in the brooding room which was earlier warmed/heated with burnt charcoal. Weak and deformed chicks were separated from the healthy ones. Using tray feeders and chick drinkers, feed (commercial broiler starter) were provided and the water in the drinkers contained anti stress and glucose for the chicks to overcome stress. The chicks were brooded for seven days. They were weighed and transferred to the pens after brooding. The compounded experimental diets whose formulations are shown in Tables 1and 2 were fed *ad libitum*. Fresh clean drinking water with liquid multivitamins was also given *ad libitum* throughout the days of the experiments. Routine medications and vaccinations were also given. The litter material used was occasionally turned and was changed during the finisher phases.

2.3 Data Collection

The experiment lasted for eight weeks, within the experimental period, the birds were given the experimental diets and the following parameters were recorded:

2.3.1 Feed intake (g)

Daily feed allowance was weighed before giving to the birds. In the morning of the following day, the left over feed was collected and weighed before the day's feeding. The feed consumed by the birds for the day was obtained by difference. Daily feed consumption per bird was obtained by dividing the total feed consumed by the total number of birds in each replicate.

2.3.2 Body weight gain (g)

Birds were weighed in group per replicate at the beginning of the experiment and subsequently weighed at weekly interval. The average weight was obtained by dividing the total weights of the birds by the number of birds weighed per replicate.

2.3.3 Feed conversion ratio

This was calculated by dividing feed intake by weight gain as shown in the relationship: Feed Conversion = feed intake/weight gain

3.0 Data analysis

Data so generated were analysed using Analysis of variance technique (ANOVA Balanced Designs) as described by Steel and Torrie (1984)) and means were separated using Student Newman Keuls (SNK).

4.0 Results and Discussions

The growth performance of broilers at the starter phase (0 – 4 weeks) as affected by partially cooked sweet potato meal is presented on Table 3. The daily feed intake (44.19g to 48.35g) obtained on all the five diets were similar. However, birds on the control consumed slightly more feed than those on the tested diets (diets 2 - 5). Daily feed intake values decreased with increased levels of PCSPM. Daily weight gains (12.55 – 15.55g) were significantly ($P<0.01$) affected by the levels of PCSPM. The feed conversion ratio was also significantly ($P<0.01$) affected by the dietary treatments. Survivability was 100 % for all the treatments.

The growth performance of broilers at the finisher phase (4 – 8 weeks) as affected by partially cooked sweet potato meal is presented on Table 3. In the finisher phase, significant (P<0.05) dietary effects on daily feed intake was established. Values for weight gain ranged from 40.8g (diet 4) to 44.8g (diet 5). However, there is no significant difference among the treatment means. The feed conversion ratio values (2.5 – 2.6) varied among the treatment means however, significant (P<0.05) dietary effects was obtained. There was no mortality based on the survivability values (99 – 100 %).

The overall performance of broilers (0 – 8 weeks) as affected by partially cooked sweet potato meal is presented in Table 3. Considering the overall performance of birds on the different levels of partially cooked sweet potato meal, daily feed intake was significantly (P<0.05) affected by the dietary treatments, however, significant difference was not observed on daily weight gain and feed conversion ratio studied. Daily weight gain values ranged from 27.2g to 30.3g and indicated a consistent decrease with increasing levels of PCSPM. Values ranged (2.0 – 2.1) for feed conversion ratio. Values for survivability ranged from 97 to 100%.

The economics of production of broiler chickens fed diets containing graded levels of fermented cassava root meal and groundnut cake is presented in Table 4. Total feed intake values shows that birds on diets; 1 and 5 consumed more feed (3.33 kg and 3.34kg) than those on diets 2, 3 and 4. Feed cost in Naira per kilogramme consistently decreased with increasing levels of inclusion of FCRM. The total feed cost, total weight gain and feed cost naira per kilogramme gain followed a similar trend with feed cost.

Significantly dietary influence was not observed on daily feed intake in the starter phase. Even though, feed consumption consistently declined as the level of inclusion of the partially cooked sweet potato (PCSPM) increased. The lack of significant difference in this study is in agreement with reports on broilers (Dominguez, 1991; Guigui, 2006 unpublished). The possible reason for the good intake of the diets by the birds may be as a result of the partial cooking. Canope *et al*. (1977) had found that cooking improved digestibility of nutrients and reduced trypsin inhibitors present in sweet potato.

The inclusion of PCSPM had a negative effect on performance of birds in terms of daily weight gain and feed conversion ratio during the starter phase. Daily weight gain consistently decreased with increasing level of inclusion of PCSPM. The FCR however, increased with increasing levels of inclusion of PCSPM on feed conversion ratio. This is in agreement with the report (Maphosa, *et al*., 2003 and Ayuk, 2004) that inclusion of sweet potato had a negative effect on performance. It is also similar to the report of Obeh and Tewe (1992) when broilers were fed sundried and oven dried sweet potato meals. This finding could be linked to the nutritional characteristics peculiar to sweet potato. This corroborates the report of Esonu *et al*. (2000) that inclusion of wild aerial yam bulbils meal depressed the performance of broiler chickens.

Feed intake of birds on the finisher diets was lower than the control at inclusion levels of 20, 40 and 60%. However, at the highest level of inclusion (80%), feed intake was similar to the control. The dietary effect observed in this study agrees with the report of Maphosa *et al*. (2003), Adelina (2002), and Obeh and Tewe (1992). It however, disagrees with observations with broilers (Dominguez, 1991; Agwunobi, 1999 and Guigui, 2006) and rabbits (Ngodigha and Okejim, 1999; Shoremi *et al*., 2001). Dietary influence was not statistically obtained on the daily weight gain and feed conversion ratio. This trend disagrees with the reports of Adelina (2002), Obeh and Tewe (1992), Guigui (2006) and Maphosa *et al*., (2003) but is similar to the report of Dominguez (1991). The finding in this study suggests that, as an energy source and at these levels of inclusion, the sweet potato meal is as efficiently used as maize. It is also clear as suggested by

Dominguez, (1991) that cooking does not significantly affect the utilization of energy but increased the digestibility of nutrients. This agrees with the reports with broilers by Garba *et al*, (2006) who found no significant difference in performance parameters and linked this to the inactivation of trypsin inhibitors found in sweet potato meal and is said to impair protein digestion and reduce body weight.

The levels of inclusion of cooked sweet potato in this study did not affect performance in terms of daily weight gain and feed conversion ratio. It however, affected daily feed intake. Daily feed intake was depressed at 60% level of inclusion of cooked sweet potato meal when compared to the control. This is attributed to dustiness (Adelina 2002) and antinutritional factors (Adelina, 2002; Dominguez, 1991, Maphosa *et al*; 2003 and Ayuk, 2004). Daily weight gain consistently decreased with increasing levels of inclusion of PCSPM. However, there was similarity in value between the control and the other diets containing PCSPM with only a slight increase at higher levels of inclusion. The good performance generally obtained in this study could be attributed to the high(3.6 %) fibre in the diets, since Tewe (1986) reported that inclusion of fibre in diets containing high sugar levels (as is the case in this study) reduces gastro intestine disorder.

The costs of feed per kilogramme consistently decreased with increasing level of inclusion of FCRM, this finding disagree with the report of Tewe (1994). This could be as a result of the cost of the various feed ingredients at the time of the feeding trial. The cost per kilogramme gain obtained in this study progressively decreased with increasing levels of inclusion of FCRM. This trend was reported by Adelina (2002). The cost of producing a kilogramme of broiler meat was lowest (#29.22k) in diet 5 (80% FCRM) cheaper than in the control diet (#33.24k).

4.0 Conclusions

Performance was depressed beyond 20 % partially cooked sweet potato meal PCSPM level in the starter phase. However, body weight gain was not affected by the dietary levels of PCSPM at the finisher as well as the pooled performance. It is therefore concluded that PCSPM could be included in broiler chickens diet at up to 80% level.

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Table 1: Ingredient and nutrient compositions (%) of broiler starter diets containing partially cooked sweet potato meal (PCSPM)

	DIETS				
Parameters	**1 (0%)**	**2 (20%)**	**3 (40%)**	**4 (60%)**	**5 (80%)**
Maize	48.70	39.00	29.22	19.50	9.74
Fullfat soyabean meal	33.10	33.10	33.10	33.10	33.10
PCSPM	0.00	9.74	19.50	29.22	39.00
Fishmeal	5.00	5.00	6.00	7.00	8.00
Wheat offal	10.00	10.00	9.00	8.00	7.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Vitamin/minearal premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Nutrient composition					
Crude protein	23.10	22.60	22.70	22.70	22.70
ME(Kcal/kg) **	3029	2835	2650	2467	2283
Crude fibre	3.60	3.60	3.50	3.40	3.30
Ether extract	7.70	7.50	7.30	7.20	7.10
Phosphorus	1.10	1.00	1.00	1.00	1.00
Calcium	1.30	1.30	1.30	1.40	1.50

Note: * Each 2.5kg contains; Vit. A 10,000,000iu, Vit. D3 2,000,000iu, Vit. E 23,000mg, Vit. K3 2,000, Vit. B1 1,800mg, Pantothenic Acid 7,500mg, Vit. B6 3,000mg, Vit. B12 15mg, Folic Acid 750mg, Biotin H2 60mg, Choline Chloride 300, 000mg, Cobalt 200mg, Copper 3,000mg Iodine 1,000mg, Iron 20,000mg, Manganese 40,000mg, Selenium 200mg, Zinc 30,000mg, Antioxidant 1,250mg

** - Metabolisable energy.

Table 2: Ingredient and nutrient compositions (%) of broiler finisher (21%) diets containing partially cooked sweet potato meal (PCSPM)

	DIETS				
Parameters	**1 (0%)**	**2 (20%)**	**3 (40%)**	**4 (60%)**	**5 (80%)**
Maize	49.07	39.26	30.24	18.83	9.81
Fullfat soyabean meal	28.23	28.23	28.23	28.23	28.23
PCSPM	0.00	9.81	18.83	30.24	39.26
Fishmeal	4.00	5.00	6.00	8.00	10.00
Wheat offal	15.00	14.00	13.00	11.00	9.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vitamin/minearal premix*	2.50	2.50	2.50	2.50	2.50
Salt	2.50	2.50	2.50	2.50	2.50
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Nutrient composition					
Crude protein	21.00	21.00	21.00	21.00	21.00
ME(Kcal/kg) **	2943	2757	2516	2379	2210
Crude fibre	3.80	3.70	3.40	3.40	3.20
Ether extract	6.60	6.40	6.30	6.10	6.00
Phosphorus	1.20	1.20	1.20	1.20	1.20
Calcium	1.50	1.60	1.60	1.70	1.80

Note: * Each kilogram contains; Vit. A 3600,000iu, Vit. D_3 600,000iu, Vit. E 4,000,000mg, Vit B_1-B_{12} 640, 1600, 600, 4.00mg, Pantothenic acid 2000mg,Biotin 300mg,Manganese 16000mg, Biotin 300mg, Manganese 16000mg,Selenium 80mg, Vit K_3 600mg, Cobalt 80mg, Copper 1200mg, Zinc 12,000mg, Folic acid 200mg, Choline Chloride 70000mg, Antioxidant 500mg

** - Metabolisable energy.

Table 3: Performance of broiler chickens fed diets containing graded levels of partially cooked sweet potato meal (PCSPM)

Parameters	DIETS 1 (0%)	2 (20%)	3 (40%)	4 (60%)	5 (80%)	SEM
Starter phase (0-4 Weeks)						
Daily Feed Intake (g)	48.35	47.86	47.77	47.19	47.19	0.72^{NS}
Daily Weight gain (g)	15.55^{a}	15.42^{a}	14.55^{b}	13.66^{c}	12.55^{d}	0.44^{**}
Feed Conversion Ratio	3.11^{d}	3.11^{d}	3.29^{c}	3.47^{b}	3.82^{a}	0.12^{**}
Survivability (%)	100	100	100	100	100	_
Finisher Phase (4-8 weeks)						
Daily Feed Intake (g)	112.1^{a}	105.8^{b}	105.2^{b}	105.6^{b}	112.1^{a}	1.81^{*}
Daily Weight gain (g)	42.2	40.9	41.4	40.8	44.8	2.54^{NS}
Feed Conversion Ratio	2.5	2.6	2.6	2.6	2.5	0.14^{*}
Survivability (%)	100.00	99.00	100.00	100.00	99.00	_
Overall/pooled (0-8 weeks)						
Daily Feed Intake (g)	59.5^{a}	56.3^{b}	56.5^{b}	56.2^{b}	59.6^{a}	0.93^{*}
Daily Weight gain (g)	30.3	28.2	28.0	27.2	29.0	1.17^{NS}
Feed Conversion Ratio	2.0	2.0	2.0	2.1	2.1	0.09^{NS}
Survivability (%)	100.00	99.00	100.00	98.00	97.00	_

Note: ^{abc} Means bearing different superscripts within the same row differ (**=P<0.01), (*=P<0.05), SEM - standard error of means, NS - not significant

Table 4: Economics of production of broiler chickens fed diets containing partially cooked Sweet potato meal (PCSPM)

	DIETS				
Parameters	**1 (0%)**	**2 (20%)**	**3 (40%)**	**4 (60%)**	**5 (80%)**
Total feed intake (kg)	3.33	3.15	3.16	3.15	3.34
Feed cost (₦/kg)	16.97	16.50	15.97	15.45	14.17
Total feed cost (₦)	56.51	51.98	50.47	48.67	47.33
Total weight gain (kg)	1.70	1.58	1.57	1.52	1.62
Feed cost ₦ /kgGain	33.24	32.90	32.15	32.02	29.22

Note: ₦- Nigerian Naira, 0, 20, 40, 60 and 80% - levels of inclusion of PCSPM

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