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Research

Growth parameters and economic analysis of broiler finisher birds' production fed sugarcane scrapping meal (SCSM)-based diets

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Abstract

One hundred and eighty 4 weeks-old Anak 2000 broiler finisher birds were utilized in a 28-day experiment to determine the effect of replacing maize with sugarcane scrapping meal (SCSM) on their growth performance indices and economics of production. Five experimental diets T_1, T_2, T_3, T_4 and T_5 were compounded to be isonitrogenous (20% crude protein) and isocaloric (2800Kcal/Kg ME) with varying levels of sugarcane scrapping meal (SCM) inclusion. Having obtained the proximate composition of the test ingredient (sugarcane scrapping meal), the experimental diets were formulated such that the test ingredient replaced maize at 0%, 25%, 50%, 75%, and 100% levels for treatments 1, 2, 3, 4, and 5, respectively such that T_1 serves as the control. The birds were randomly allocated to the 5 dietary treatments at the rate of 36 birds per treatment and replicated four times having 9 birds each. All experimental birds were given weighed amount of feed and water was provided ad libitum. The result indicated that final weight and intake of feed were not significantly ($P>0.05$) affected by the different levels of inclusion of SCSM in the diets. Feed conversion ratio and protein efficiency ratio were improved ($P>0.05$) in birds fed diets T_2 (5.02±0.64 and 0.88±0.11) T_3 (5.47±0.25 and 0.80±0.04), T_4 (5.60±0.46 and 0.83±0.14) and T_5 (5.60±0.46 and 0.78±0.12), respectively compared to those in the control T_1 (3.87±0.36 and 1.13±0.10) respectively. Similarly, body weight gain increased ($P>0.05$) in birds fed the control diets (555±0.10g) than the other diets (540±0.0 vs. 543±0.02 vs. 542±0.0 and 547±0.0 g) while cost of feed consumed and cost of feed per weight gain were better in diet T_1 (308.53±49 N/kg) than the rest of the diets and dietT_2 (95.21±9.46 N/kg) than the other diets, respectively. There was no significant difference ($P>0.05$) in the cost of production, revenue generated and gross margin due to the replacement of SCSM with maize in the diets. From this study, SCSM can replace maize in poultry diets up 100% owing to the fact that the birds performed uniformly between treatments2 and 5 without any deleterious effect

Keywords: Sugarcane scrapping meal, broiler finisher birds, economics analysis of production and growth performance.

Introduction

The problem of malnutrition in Nigeria is mainly attributed to low intake of animal protein both in quantity and quality. FAO (1997) recommended a protein consumption level of 65g per day of which 35g should be from animal source. Oyenuga (1991) and ILCA (1993) reported about 6.8g as the level of animal protein consumption in Nigeria while Ibe (1999) reported animal protein consumption of 7.0gcaput/day as against the recommended intake. This represents a gross shortfall of 75%. Therefore, the livestock sub-sector of the Nigerian economy is not fulfilling its primary role of satisfying the protein requirements of the nation. This implies that livestock production has to improve drastically if the ever-increasing demands for animal products in the diets of the people in the developing countries are to be met (Adebambo, 2000). The shortage and high price of animal protein have been aggravated by the high cost of conventional feed ingredients.

The use of unconventional feedstuffs as substitutes for grains and other feedstuffs have been suggested thus, the search for non-conventional feedstuffs has been the most active area of animal nutrition research in the tropical world (Ikani and Adesehinwa, 2000). The search for cheaper sources of animal protein brings poultry birds into focus. Abdulmojeed *et al.* (2010) suggested that the quickest potential for bridging protein supply-demand gap lies in the production of highly prolific animals that are efficient converters of feed to flesh, have short generation interval such as poultry and the integration of the wide array of cheap and locally available non-conventional feedstuffs at our disposal into well-defined feeding systems to reduce cost. One of such agro-industrial waste products is sugarcane scrapings.

According to Ayoade *et al.* (2007), sugarcane scrapping is obtained by scraping the outer part of the stem (rind) with a sharp knife to remove the bark on the stem that affords protection to the underlying cells. The scraping is done to remove the wax-covered epidermis and prepare the stem for chewing. The scrapings consist of the wax, pigments and fibrous materials of the rind, and a small quantity of the underline parenchyma cells. After scrapping, the material lies waste littering in both urban and rural settlements hereby constituting environmental pollution. It is heaped and burnt from time to time. Livestock such as cattle, goat and sheep scavenge these residues. Possible uses of the scrapings include feed for livestock and fuel for cooking. This could translate to substantial savings of money in this era of exorbitant prices of kerosene. The scrapping could also be used as mulching material for plants and when decayed could constitute a source of manure for the soil. The proximate and energy composition of SCSM, according to the findings of Ayoade *et al.* (2007) indicates that dry matter is about 87.6%, crude protein 3.2%, crude fibre 12.7%, Ether extract 2.8%, ash 12. 8%, NFE 77.1% and gross energy of about 2.84 Mcal/kg. Augustine (2005) investigated the

effect of replacement of maize with graded levels of sugarcane scraping meal (SCSM) on the performance and carcass characteristics of growing rabbits where SCSM replaced maize at 0, 25, 50, 75 and 100% for treatments 1, 2, 3, 4 and 5 and reported that the rabbits gained weight in all the treatments throughout the period of study while the digestibility of various nutrients and dressing percentages were high. These are indications of good nutritive value of SCSM in rabbit's rations. The author also reported that replacement of maize with SCSM reduced the production cost and could make rabbit available to the general public at lower cost. This is attributed to the fact that SCSM is very cheap compared to maize. Since body weight gain, and feed conversion ration were similar among treatments and there is reduction in production cost and profit increased as a result of the inclusion of SCSM, the author concluded that SCSM could replaced up to 100% of the maize in the diets of grower rabbits without adverse effect on performance. The objective of this study is therefore, to determine the effect of replacing maize with sugarcane scraping meal on the growth performance and economic analysis of broiler birds production.

Materials and Methods

Study area

The experiment was carried out at the Research and Teaching Farm of the Faculty of Agriculture, Nasarawa State University, Keffi, Shabu – Lafia Campus. It is located in the guinea savanna zone of North Central Nigeria. It is found on latitude 08^0 35'N and longitude 08^0 33' E. the mean monthly maximum and minimum temperatures are 35. 06 and 20.16^0C respectively while the mean monthly relative humidity is 74%. The rainfall is about 168. 90mm. (NIMET, 2008)

Experimental diets for broiler finisher birds

Five experimental diets T_1, T_2, T_3, T_4 and T_5 were compounded to contain isonitrogenous (20% crude protein) and isocaloric (2800 Kcal/Kg ME) with varying levels of sugarcane scrapping meal (SCM) inclusion. The experimental diets were formulated such that SCM replaced maize at 0%, 25%, 50%, 75%, and 100% levels for treatments 1, 2, 3, 4, and 5 respectively; treatment T_1 (0% SCSM) served as the control. Other ingredients were included at the recommended levels to meet the nutrient requirements of the birds. The composition of the experimental diets for finisher phase is presented in Table 1.

Experimental birds and management

A total of 180 Anak 2000 broiler chicks at 4 weeks old were utilized in a 28-day experiment. The birds were randomly allocated to the five dietary treatments at 36 birds per treatment and replicated four times. All experimental birds were given weighed amount of feed and water was provided *ad – libitum.* The difference between the feed supplied and the left over were used to calculate the feed intake. Standard management practices were

adopted as outlined by Oluyemi and Robert (2002).

Data collection

The growth response parameters taken were body weight, measured individually on a weekly basis; feed consumption was recorded on a pen basis daily by finding the difference between the amount offered and the left over collected the following day (this was later expressed on a weekly basis); body weight gain was determined weekly while feed conversion ratio was calculated by dividing feed intake by weight gain. Protein efficiency ratio (PER) was determined as the gain in body weight to the amount of protein consumed by a bird.

The prevailing market price of feeding stuffs was used to calculate the cost of feed per kilogram of broiler starter and finisher diets. Feed intake per bird for the 4–week experimental period was used to multiply the cost of feed consumed by a bird. The cost per kilogram weight gain was calculated using the procedure of Abdulmojeed *et al.* (2010) by taking the product of cost per kilogram feed and feed conversion ratio of birds. The cost of production was estimated as the product of cost per kilogram weight gain and mean total weight gain, while revenue was calculated as price of meat multiplied by mean total weight gain. The gross margin was estimated as the difference between revenue and cost of production.

Statistical analysis

Data obtained were subjected to one way analysis of variance (ANOVA). The separation of means was effected using least significant difference method and tested at probability level of 5% as described by Steel and Torrie (1980). Each experimental bird was randomly assigned to a test diet in a Completely Randomized Design (CRD). The following statistical model was used:

$Y_{ij}=U+T_1+\mu_{ij}$

Where $Y_{ij=}$ Individual observation

U = Population Mean

T_1 = Treatment Error

μ_{ij} = Random error

RESULTS AND DISCUSSION

Chemical composition of sugarcane scrapping

The chemical composition of the test ingredient (sugarcane scrapping) is presented in Table 1.The calculated metabolizable energy from the proximate composition data using the formula described (Pauzenga, 1985) ME (kcal/kg) = 37x % cp x 81.1 x % EE + 35.5 x % NFE was about 2970.45. The test ingredient contain low (8.25%) crude protein, high crude fibre and low (3.36%) either extract. The dry matter was about 90.67% while ash and nitrogen free extract were about 9.98 and 67.40% respectively. This composition suggests that sugarcane scrapping, being a fibrous feed material, will require some level of processing or pre-digestion if it must be fed to monogastric animals. The fibre fraction, NDF (neutral

detergent fibre), ADF (acid detergent fibre), ADL (acid detergent lignin), hemicelluloses and cellulose were within the range of 39.96 - 56.38%, 19.21 - 38.21%, 5.92 - 6.37%, 18.17 - 24.90% and 13.12 - 25.84%, respectively and are typical of fibrous materials.

Growth performance of broiler finisher

The effect of replacing maize with sugarcane scraping meal on the growth performance of broiler finisher is presented in Table 3. The results showed that initial body weight, final body weight and feed intake were not influenced ($P>0.05$) by the various levels of SCSM inclusion in the diets. The values obtained for feed conversion ratio (3.87), protein efficiency ratio (1.13) and weight gain (555g/bird) were significantly ($P<0.05$) better in birds fed diet T_1 compared to those fed the other treatments; birds fed treatments T_2, T_3, T_4 and T_5 performed uniformly. The feed intake regime in this study which varied from 283 to 298g/day was close to those previously reported (Oluyemi and Robert, 2002). The average daily weight gains of the birds in this study 53 to 74g/day were in agreement with the 35.71 to 45.71g/day reported by Etuk *et al.(*2003), when an experiment was carried out to study the effect of methionine supplementation on the performance of finisher broilers fed pigeon pea seed meal based diet. Similarly, the results are in agreement with the findings of Tuleun *et al.* (1998), Atteh (2000) and Thompson and Webs (1981) who observed an increase in feed intake as dietary fibre levels increased in the diets of starter chicks. Increased feed intake is known to be directly connected to low energy diets which is associated with high fibre diets. Similarly, it is known that one of the general effects of fibre is depressed digestibility and reduced availability of nutrients. It is therefore possible that the inclusion of sugarcane scraping meal at the various levels in treatments T_2 (25%), T_3 (50%) T_4 (75%) and T_5 (100%) could have made these diets more fibrous thus; making the birds to eat more to compensate for the reduced energy density of the diet. The nutrients derived from diets are what determine weight gains when absorbed and deposited. This explains the observation of significant reduction across the treatments in the weight gain by the birds as the level of sugarcane scraping meal increased from T_1 to T_5 in the diets. The efficiency of feed utilization increased, as the levels of SCSM increased in the dietary treatments, an indication that, the birds in the control diet were more efficient in converting feed to edible meat more effectively. It is known that, fibre in the diet of monogastric animals impairs the utilization of other nutrients especially crude protein utilization (Savage *et al*., 1980; Delmore and Wojeik, 1982).

Fibre is known to reduce digestibility and absorption of nutrient by forming complex with the macronutrients (McDonald *et al.,* 1995), thus impairing weight gain since the nutrients are what in turn, become the tissues in the body. Birds fed the low fibre diets consumed

more water. This may be explained by the fact that the high nutrient density in the low energy diet allows the birds to meet the calorie requirement quite earlier than those fed the high fibre diets. This implies that water intake will rise in this group (low fibre diet) to meet its water requirement. This observations is consistent with findings of Isikwenu *et al*. (2005) who conducted an experiment to investigate the effect of dietary fibre (maize cob) levels on growth performance of broiler birds and observed that growth rate were significantly affected by increasing fibre levels and emphatically stressed that average body weight gain which is in the index of the growth rate measurements showed marked significant difference with the rations that have 0-10% fibre levels; performing better than those with 15 - 20% fibre levels. The values reported in this study were also similar to (Alu *et al.,* 2010).

Protein efficiency ratio result was in direct opposite to the trend for feed efficiency. Birds fed treatments T_2, T_3, T_4 and T_5, diet were the most efficient ($P<0.05$) in converting dietary protein into flesh (edible meat) compared to the control diet T_1. The protein efficiency ratio in this study 0.78 to 1.13 was within the normal range (1.50 to 2.07) as reported by Etuk *et al*. (2003).

Economics of production

The results obtained on the economics of production of broiler finisher birds using sugarcane scraping meal are presented in Table 4. Feed costs per kilogram were within the range of N40:47k to N60:22k. There was no significant difference ($P>0.05$) in the gross margin, revenue, and cost of production. Feed cost consumed significantly decreased ($P<0.05$) as the level of SCSM in the diets increased with birds fed diet T_1 having the highest (308.53N/kg). Birds fed treatment T_2 had the highest (95.21N/kg) feed cost per weight gain compared to the other treatments. The results are in agreement with the findings of Ayoade *et al.* (2007) who investigated the effect of replacing SCSM with maize on the growth performance and economics of production of rabbits and observed that there were stepwise reductions in production cost as the level of SCSM in the diet increases leading to gradual increments in profit. Again, reduction in the cost of production and feed cost per kg gain of broiler bird with increase in the level of SCSM indicates the potentials of reducing cost of producing birds by the inclusion of SCSM in boiler diets. The consequent increase in savings per kg gain observed in this study might not appear to be large, but when computed for several birds could give a substantial reduction in cost of production and result in increase profitability of the poultry industry on the long run. The values obtained for cost of feeding (40.47 to 60.22 N/kg) in this study are similar (32.7 to 42.2N/kg) to those reported by Yusuf *et al.* (2009) but vary in the cost of feed per weight gain (76.71 to 95.21N/kg).

Conclusion

The study demonstrated that sugarcane scraping meal can totally replace maize in the diets of broiler finisher birds without adversely affecting their growth performance. It was also shown that it reduces the cost of production in general.

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performance of growing pullets in a semi-arid environment. Trop. J. Anim. Sc., Dec. 2009, vol. 11:40-46.

Table 1. *Proximate and energy composition of sugarcane scrapping*

Nutrient	%
Crude protein	8.25
Crude fat	3.36
Crude fibre	36.48
Ash	9.98
Dry matter	90.67
NFE	67.40
[a]Energy (Kcal/kg ME)	2970.45

[a]Calculated from Pauzenga (1985)

Table 2. *Percent and chemical composition of the experimental diets for broiler finisher birds (%)*

Feed stuffs	D T_1 (0%)	I T_2 (25%)	E T_3 (50%)	T T_4 (75%)	S T_5 (100%)
Groundnut cake	14.25	14.25	14.25	15.00	15.80
Maize	34.00	25.50	17.00	8.50	-
SCM	-	8.50	17.00	25.50	34.00
Fullfat soya bean	14.00	14.85	16.60	17.60	18.50
Maize bran	31.40	30.30	28.55	26.80	24.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Blood meal	2.00	2.50	2.50	2.50	2.50
Sodium chloride	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25
Palm oil	1.50	1.25	1.25	1.25	1.85
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated chemical and energy composition					
Energy (Kcal/Kg ME)	2954.07	2897.98	2861.57	2819.39	2810.53
Crude protein (%)	20.04	20.14	20.11	20.13	20.07
Crude fibre (%)	5.49	6.27	7.02	7.76	8.44
Calcium (%)	0.89	0.90	0.93	0.96	1.03
Phosphorus (%)	0.61	0.61	0.61	0.62	0.62
Ether extract (%)	7.21	6.92	7.02	7.02	7.65
Lysine (%)	0.98	1.00	1.02	1.04	1.05
Methionine (%)	0.43	0.42	0.41	0.40	0.39

T_1 = 0% level of sugarcane scrapping, T_2 = 25% level of sugarcane scrapping, T_3 = 50% level of sugarcane scrapping, T_4 = level 75% of sugarcane scrapping and T_5 = 100% level of sugarcane scrapping.

-The premix (vitamin-mineral) supplied the following per 100kg of diet: Vitamin A 15,00 I.U, Vitamin D_3 300,00 I.U, Vitamin E 3,000 I.U, Vitamin K 2.50mg, Thiamine (B_1) 200mg, Riboflavin (B_2) 600mg, Pyridoxine (B_6) 600mg, Niacin 40.0mg, Vitamin (B_{12}) 2mg, Pantothenic acid 10.0mg, Folic acid 100mg, Biotin 8mg, Choline chlorine 50g, Anti-oxidant 12.5g, Manganese 96g, Zinc 6g, Iron 24g, Copper 0.6g, Iodine 0.14g, Selenium 24mg and Cobalt 214mg.

Table 3. *Effect of replacing maize with sugarcane scrapping meal (SCSM) on the growth indices of broiler finisher birds* (Means±Se)

Parameters	D T_1 (0%)	I T_2 (25%)	E T_3 (50%)	T T_4 (75%)	S T_5 (100%)	LOS
Initial body weight/bird(g)	903±0.01	900±0.02	907±0.01	904±0.01	903±0.01	N
Final body weight /bird(g)	1456±1.10	1468±0.09	1068±0.03	1077±0.04	1070±0.08	NS
Feed intake/bird(g)	283±0.14	288±0.10	293±0.07	296±0.03	298±0.02	NS
FCR	3.87±0.36[b]	5.02±0.64[a]	5.47±0.25[a]	5.60±0.46[a]	5.65±0.80[a]	*
PER	1.13±0.10[a]	0.88±0.11[b]	0.80±0.04[b]	0.83±0.14[b]	0.78±0.12[b]	*
Body weight gain/bird(g)	555±0.10[a]	540±0.08[b]	543±0.02[b]	542±0.04[b]	547±0.08[b]	*

-a,b,- Means on the same row bearing different superscript differ significantly ($P < 0.05$), NS = No significant difference ($P > 0.05$), LOS = Level of significant difference, T_1 = 0% level of sugarcane scrapping, T_2 = 25% level of sugarcane scrapping, T_3 = 50% level of sugarcane scrapping, T_4 = level 75% of sugarcane scrapping and T_5 = 100% level of sugarcane scrapping.

Table 4: *Economic analysis of production of broiler finisher birds fed graded levels of sugarcane scrapping meal (SCSM) based diets* (Means±Se)

Parameters	D T_1 (0%)	I T_2 (25%)	E T_3 (50%)	T T_4 (75%)	S T_5 (100)	LOS
Feed cost/ kg(N/kg)	60.22	52.32	48.41	48.02	40.47	-
Feed cost consumed(N/kg)	308.53±49.[a]	232.68±39.[b]	221.10±14.98[b]	216.99±20.41[b]	227.08±46[b]	*
Feed cost/weight gain(N/g)	82.82±11.7[b]	95.21±9.46[a]	90.61±4.03[b]	91.00±7.01[b]	76.71±10.[b]	*
Cost of production(N)	60.22±0.01	57.21±0.01	48.41±0.01	48.01±0.01	40.42±0.31	NS
Revenue (N)	368.75±49.220.74	290.00±39.37	269.50±14.98	265.00±20.41	267.50±40.10	NS
Gross margin(N)	308.53±49.22	232.68±39.37	221.10±14.98	216.99±20.41	227.08±40.06	NS

a,b,- Means on the same row bearing different superscript differ significantly ($P < 0.05$), NS = No significant difference ($P > 0.05$), LOS = Level of significant difference, T_1 = 0% level of sugarcane scrapping, T_2 = 25% level of sugarcane scrapping, T_3 = 50% level of sugarcane scrapping, T_4 = level 75% of sugarcane scrapping and T_5 = 100% level of sugarcane scrapping