

EFFECTS OF FEEDING SUGARCANE (*Saccharum officinarum*) BARK SCRAPING FERMENTED WITH RUMEN LIQUOR ON PERFORMANCE OF BROILER CHICKENS

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Abstract. This study was conducted to evaluate the effects of treated sugarcane bark scrapping fermented in rumen filtrate (TSBS) on the performance of broiler finisher birds. Sugarcane bark was sun dried, milled and fermented as dietary substitutes in the study. Six experimental diets coded as T₁(0%), T₂(7.5%), T₃(15%) for 4 days' fermentation and T₄(0%), T₅(7.5) and T₆(15%) for 8 days' fermentation were compounded such that TSBS replaced maize at 0%, 7.5% and 15% levels respectively in broiler finisher diet. Each treatment had three replicates in a 2x3 factorial experimental design. Data collected on feed intake and body weight gain, were used to calculate feed conversion ratio (FCR), feed cost per Kg weight gain. Mortality was recorded as it occurred. Results showed no significant (P>0.05) difference on final weight, feed cost/kg weight gain and mortality rate for both inclusion and fermentation days. However, there was significant difference (P<0.05) on the feed intake, weight gain and feed conversion ratio (FCR) of the broiler birds fed TSBS at different inclusion levels (0,7.5 and 15%). On nutrient retention of the birds fed TSBS showed that the dietary levels had significant effect (P<0.05) on digestibility efficiency of dry matter, Crude protein, Crude fibre, ash, and N.F.E retention. However, no significant (P>0.05) difference was observed in ether extract (EE) across the treatment measured. Fermentation days (4 and 8 days) had no significant (P>0.05) effect on digestibility efficiency of all the parameters measured except Crude fibre and ash retention. However, interaction of fermentation days and level of TSBS in the diet significantly (P<0.05) affect all the parameters measured except ether extract retention. The interaction between 4 and 8 days shows that irrespective of the levels of inclusion of TSBS 0%, 7.5% and 15% and number of days of fermentation 4 and 8 days, the birds performed well. In 7.5%: 4days, 7.5%:8 days, 15%:4 days, 15%: 8days show also no significant (P>0.05) difference in the experiment. The interaction on the nutrient retention show that there was significant different (P<0.05) observed in the broiler fed TSBS. The study shows that there was no significant different between 4 and 8days fermentation, therefore 4 days' fermentation is recommended to use to avoid time and stress in fermenting for 8 days and 15% is recommended based on the performance of the birds.

Keywords: sugarcane bark scrapping, broiler, performance, fermentation.

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1. Introduction

Growth in the livestock industry in Nigeria has recently fallen below expectation due to rising prices of feeds. (Owen *et al.*, 2009). This problem has been attributed to high cost of conventional feed ingredients which in effect results in high cost of production. However, the major constraints in its production have been the fact that some of the feed ingredient such as maize, sorghum and soya-beans used in compounding livestock diets are competed for by man (Ijaiya *et al.*, 2002). Poultry convert feed into food products quickly and efficiently. They are highly prolific with short generation intervals and rapid growth rate (Cheeke, 1980). Their high rate of

productivity results in relatively high nutrient needs. Feed intake is one of the important factors that may influence animal live performance, health and carcass characteristics. Feed cost is a major factor representing 50 – 70 percent of the total cost of animal production. (Bawa *et al.*, 2003; Ogunipe *et al.*, 2003). The nutrient content of a diet may affect the voluntary feed intake and growth performance of broiler chickens, feed intake depends largely on energy density.

There is need to use alternative feed materials such as treated sugarcane bark scrapping (TSBS) in feeding animals. Maize, most often, constitutes the highest proportion of ingredient in the poultry diets (Agbede *et al.*, 2002). This high inclusion rate translates into high cost of feed because of the seasonality of maize production and competition for its use by man (Agbede *et al.*, 2002). In view of this the need to replace maize in poultry diets with non-conventional feeds to reduce feed cost becomes paramount. One of such alternative feed ingredient is sugarcane bark scrapping. Sugarcane bark scrapping is an Agro-industrial by product (AIBPs) or wastes which is mainly available during the dry season. Sugarcane bark scrapping is readily fed as non-conventional feeds resource in replacing energy sources such as maize in monogastric diets (Kanyinji, 2004; Alu, 2012). Sugarcane scrapping is waste produced from scrapping the back of the sugarcane stem with a sharp knife in order to provide easier access to the underlying, soft parenchyma tissue. This scrapping are mostly heaped and sometime burnt or left, thereby constituting an environmental pollution. Sugarcane bark scrapping contains 3.2% crude protein, 12.7% crude fibre, 2.8% ether extract, 12.8% ash, 77.1% nitrogen free extract, and 2.84MKcal/Kg gross energy (Ayoade *et al.*, 2007). This however suggests that it can be a good source of energy for animals.

Rumen liquor is the fluid left when the rumen content is filtered and large particles are discarded. It is well known that rumen fluids contain a large amount of micro-organisms. Because of the presence of these microbes, ruminants can utilize feedstuffs (cellulose, hemicelluloses, and non-protein nitrogen) that provide little to no nutritional benefit to non-ruminants. It is anticipated that fermentation of sugarcane bark scrapping with rumen liquor will have a two-fold advantage to broiler chickens. Fermentation will probably reduce the fiber proportion in the sugarcane bark scrapping and will make more of the plant phosphorus available to the birds. Treatment of sugarcane bark scrapping with rumen liquor has not been investigated previously. The bacteria in the rumen liquor act on the fiber part of the cane which ultimately lowers fiber contents and makes more of the organic phosphorus available to the birds. Therefore, this study was conducted to evaluate the effects of feeding sugarcane bark scrapping fermented in rumen liquor on the performance of broiler finisher chickens. To evaluate the effects of sugarcane bark scrapping fermented with rumen filtrate on broiler finisher chicken.

Specific objectives if this study were to;

1. Evaluate the growth performance of broilers fed rumen liquor fermented sugarcane bark scrapping
2. Determine which level (0, 7.5 and 15%) and fermentation days (4 or 8 days) that will give the best performance when fed to broiler chickens.

2. Materials and methods

This research was carried out at the poultry unit of Department of Animal Science, Faculty of Agriculture, University of Abuja Teaching and Research Farm, along airport road, main campus. The project site lies between latitude 8.917°N, 7.1811°E.

The experimental birds were obtained from a commercial hatchery with good record of bird's performance.

Fresh bovine rumen filtrate was collected in a large quantity from carcasses of bovine slaughtered at a local abattoir in Suleja-Niger State. The cattle were slaughtered and eviscerated, and their gastrointestinal tracts (GIT) were immediately emptied into a clean container. The solid materials were discarded while the fluid (liquor) part of the content was transferred into a white nylon bags. This process took approximately 40-50 minute. The sugarcane bark scrapping (SBS) were source from local sugarcane market within Suleja and Madalla area of Niger State, sun-dried, milled to form the sugarcane bark scrapping meal (SBSM).

Milled sugarcane bark was measured into two places and equal portion of fresh rumen liquor was also measured out for both 4 and 8 days' fermentation. The fresh rumen liquor was sprayed on top of the SBSM that was measured. After spraying and mixing of the two to moist to enable fermentation take place. It was packed into black industry polyethylene bags, which were made airtight to secure an anaerobic fermentation in the drums. The SBSM were fermented in the two different drums of about 70 liters each for a total of four (4) days and eight (8) days which becomes treated sugarcane bark scrapping (TSBSM). At end of the fermentation days they were sun-dried for about 4days to reduce the moisture content. The dried feedstuffs were used in compounding the broiler finisher feeds for the experimental diets.

The experimental design was a 2 x 3 factorial arrangement, consisting of two days of fermentation (4 and 8 days) and three levels (0, 7.5, and 15%) of inclusions of TSBSM. See figure 3.1. A total of one hundred and eighty (180) four (4) weeks old broilers were used for the experiment. The birds were randomly allotted to six (6) treatments with each treatment having three (3) replicates containing 10 birds per replicate making a total of 30 birds on each treatment. The birds were housed in a deep litter system. All routine management practices were adhered to throughout the experimental period such as administration of antibiotic, multivitamins, anti-coccidial and routine vaccines.

The feeds were weighed before giving to birds on weekly basis and the remaining are reweighed at the end of every week (7 days) to record the accurate measurement of feed fed to the animal. Feed and clean drinking water were provided *ad-libitum*. The experimental trial lasted for a period of four (4) weeks. The same type of feeders and drinkers were used to ensure uniformity in feeding and to avoid error in reading. Precautions were taken to avoid wastage of feeds by hanging the feeders.

Initial live weight of the birds was measured at the commencement of the experiment, while final body weight was recorded as the weight of birds at the end of the experiment. Feed intake was calculated as the difference between feed given and left over feed to know the actual intake while weight gain was determined by subtracting the previous body weight from the current body weight. Feed conversion ratio was calculated by dividing the average feed intake by the average weight gain as shown in

the formula below and cost of feed was calculated by using current prices of the feedstuffs.

$$\text{Feed conversion ratio} = \frac{\text{feed intake}}{\text{body weight gain}}$$

Table 1. Composition of broiler finisher diets

Days of fermentation	4			8		
	0%	7.5%	15%	0%	7.5%	15%
Maize	63.65	58.15	52.65	63.65	58.15	52.65
TSBSM	0	7.50	15.00	0	7.50	15.00
SBM	31.00	29.00	27.00	31.00	29.00	27.00
Fish meal	2.0	2.0	2.0	2.0	2.0	2.0
Limestone	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	1.80	1.80	1.80	1.80	1.80	1.80
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Vitamin premix*	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Analyzed values						
Dry matter	93.15	92.67	90.46	93.15	93.41	92.98
Crude protein	22.75	21.75	20.75	22.75	21.69	20.15
Crude fiber	5.08	6.23	6.19	5.08	5.66	7.08
Ether extract	5.10	5.42	4.69	5.10	5.01	4.33
Ash	7.31	7.11	6.38	7.31	8.01	6.55
Nitrogen free extract	52.91	52.22	59.05	52.91	52.98	58.27
MEKCAL/KG	3137.24	3099.69	3225.46	3137.23	3094.85	3188.67
Feed cost (₦)	143.16	140.88	136.84	143.16	140.88	136.84

*Bio Mix Finisher(BIO-ORGANICS) Premix used containing the following per kg: Vit A: 8,000.000 I.U., VitE : 7,000mg, Vit K: 1,500mg, Vit B1:2,000mg, Vit B2: 2,500mg, Niacin: 15,000mg, Pentatonic Acid: 5,500mg, Vit B6:2000mg, Vit B12: 10mg, Folic Acid: 500mg, Biotin Hg: 250mg, Chroline Chloride: 175,000mg, Cobalt:200mg, Copper:3,000mg, Iodine: 1,000mg, Iron:21,00mg, Manganese: 40,000mg, Selenium:200mg, Zinc:31,000mg, Antioxidant:1250mg

Chemical and statistical analyses

The samples of sugarcane bark scrapping (SBS), treated sugarcane bark scrapping (TSBS) for both 4 and 8 days and fecal samples were subjected to proximate analysis according to the procedure described by AOAC, (1990). All data generated were subjected to SPSS—statistical package for sciences, version 23 window. Significant difference among treatment means were separated using Duncan's multiple range test (Duncan, 1955). Means were considered different at ($P < 0.05$).

3. Results and discussion

Proximate analysis

The results of proximate analysis of SBSM and TSBS presented below shows that dry matter of 92.45% declined of SBSM to 88.366% and 89.53% of TSBSM 4 and 8 days', crude fiber decline from 13.13% of SBSM to 4.62% and 4.38% for both 4 days and 8 days respectively. The crude protein increase from 8 in SBSM to 10.75% and 9.20% in TSBSM for both 4 and 8 days' fermentation. The ash and ether extract also show improvement after fermentation, the value of ash before fermentation was 4.22%

in SBSM and in TSBS of 4 and 8 days was 5.93% and 5.40% respectively. Ether extract increased from 0.82 % to 2.56% and 2.50% in both 4 and 8 days.

Growth performances of broilers fed (TSBSM)

The growth performances of broilers fed (TSBSM) were as presented in Table below show that Dietary treatment had no significant ($P>0.05$) difference on the initial weight (IW), final weight, feed cost/kg weight gain and mortality rate. However, there are significant ($P<0.05$) difference on the feed intake, weight gain and feed conversion ratio of broiler birds fed TSBS at different inclusion levels (0, 7.5 and 15%). Furthermore, different fermentation days (4 and 8 days) of TSBSM had no significant ($P>0.05$) difference in all the parameters measured.

The final live weight(FLW) of broiler birds fed TSBS at different inclusion level 0%, 7.5% and 15% with the values of 1415.19, 7.5% gave 1375.25 a lower weight and 15% 1383.33 had better weight when compared the 7.5% although no significant ($P>0.5$) different exist between them. Also at different fermentation days of 4 and 8 show no significant ($P>0.5$) different.

There was significant ($P<0.05$) different observed in the feed intake of the broiler birds fed TSBSM at the different inclusion levels such that the broiler fed TSBSM at 0% had the lowest feed intake of 102.48 while 7.5% and 15% have higher feed intake of 108.41g/b/d and 105.00g/b/d respectively.

The weight gains of birds fed 0% TSBSM was significantly higher by 27.92 than those fed diets containing TSBS 26.58g and 26.60g in 7.5% and 15% respectively. The fermentation days showed no significant ($P>0.05$)

The birds fed 0% TSBSM had better FCR compared to those fed TSBSM diet of 7.5% and 15%. Judging from the Table 2. 15% gave 3.95 a better conversion ratio than 7.5% with 4.08 from all indication 15% had a better result.

Table 2. Proximate compositions of sugarcane bark scrapping and fermented TSBSM

Nutrients (%)	SBSM	Fermentation in days(TSBSM)	
		4	8
Dry matter%	92.45	88.36	89.53
Crude protein%	8.00	10.75	9.20
Crude fibre%	13.13	4.62	4.38
Ether extract%	0.82	2.56	2.50
Ash%	4.22	5.93	5.40
Nitrogen free extract	66.28	64.74	67.81
MEKcal/kg	2716.02	2966.83	2952.15

Sugarcane bark scrapping. **TSBSM:** treated sugarcane bark scrapping.

Sugarcane bark scrapping. **SBSM.** Untreated. DM is dry matter, NFE is Nitrogen Free Extract, CP is Crude Protein, CF is Crude Fiber, EE is Ether Extract

Proximate analysis

Results on proximate analysis of SBSM and TSBSM shows that dry matter drop from 92.45% to 88.36% and 83.53% in both 4 and 8 days after fermentation. The Crude fiber content drop from 13.13% to 4.36% and 4.62%, for 4 and 8 days which was in line with the report of Adeyemi and Familade (2003), they did notice similar effect when corn-cobs were fermented with rumen filtrate. The CP level was increased from 8 to 10% and 9.20% for 4 and 8 days which was an improvement. These findings support the reports of Adeyemi and Sipe (2004), Adeyemi *et al.* (2007) and Dairo *et al.* (2011) who observed an increase in the CP in cassava root meal that was fermented with rumen filtrate and nitrogen source. The ether extract, increase from 0.82% to 2.56% and 2.50%, ash also increased from 4.22% to 5.93 and 5.54% in both 4 and 8 days of fermentation while nitrogen free extract showed increase after fermentation of SBS with rumen filtrate from 66.28 to 66.45 and 67.81. From this, result, it is clear that fermentation of SBS with rumen filtrate is known to improve protein; ether extract, Ash and nitrogen free extract and reduce the crude fiber.

Growth performance of broiler birds fed TSBS

The initial body weights of birds were similar at the beginning of the experiment which shows that the birds had equal opportunity to perform. This was to avoid variation in the experiment.

The similarity of performance observed in the final live weight of broilers fed 0, 7.5 and 15% TSBS showed that fermentation of SBSM with rumen filtrate improve quality of sugarcane scrapping and is in agreement with the reports of (Dairo *et al.*, 2011) who observed an improvement in cassava root meal after fermentation with rumen filtrate.

Feed intake of broilers fed 7.5% level TSBSM was significantly higher than those fed 0% level of TSBSM. The lower feed intake observed in birds fed 0% TSBSM could be traced to energy density in the feed. This is in line with the findings of Noble and Van Milgen, 2004; Bello and Tsado (2013). The higher feed intake observed in the chickens fed 7.5 and 15% TSBSM may be traced to the TSBSM inclusion which have high fibre resulting in reduced energy density of the diet. This result disagrees with the report of Onyimonyi and Ugwu (2007).

Comparable average body weight gains of birds fed 0% level of TSBSM was significantly higher than birds fed TSBSM inclusion levels. However, there was no significant difference among birds fed TSBSM diets. Dietary treatment had significant effect on FCR. Broiler chickens fed diets without TSBSM. 0% had better FCR than TSBS fed birds. This could be attributed to better utilization of the feed because SBSM contain high crude fiber, and thus utilization of the feed was hindered.

Feed conversion ratio of the control (0%) had the best in the experiment with 3.67 and 7.5% and 15% had 4.08 and 3.95 respectively. From the two figures, it shows that 15% inclusion of TSBSM had better FCR compare to 7.5% with 4.08. Also judging from the fermentation days, they were no significant observed.

Palatability is one of the factors that could determine the extent to which an animal will consume, digest and gain weight in a particular diet. Chreay and Jones, (1982) Iyayi *et al.*, (2005) Aro *et al.* (2008) reported that swine fed fermented cassava meal based diets had high feed intake due to improved palatability of the feed. Therefore, it was likely to be that the high weight gain by the birds in the 0% treatment diet might be due to better palatability of the feeds caused by 0% levels. In this view,

birds fed diets with TSBSM consume higher than 0% also gained weight but due to the dustiness and fibrous nature of feed (TSBSM), the 0% inclusion was more palatable for the birds. TSBSM is still good alternative for poultry feed because the birds performed well.

TSBSM will go a long way in the improvement of the environmental and sanitary conditions of our country. The broiler tolerated up to 15% within the number of days on the feeding trail of twenty-eight days that the trial last. Broilers are monogastric animal and are not known to utilize much fibrous materials efficiently for there is no symbiotic relationship between the animals with simple stomach (broiler) and microbial population anywhere in the gut. therefore 15% inclusion of the TSBSM will be too high for birds if they are to stay more than twenty-eight days in feeding trial.

The mortality rate was also lower than 1% which is below a mortality rate of less than 4% regarded as normal for broiler birds Zanu *et al.* (2017). There was no observable adverse effect on the health of the broiler within the trial days. TSBSM can be a dietary replaced feedstuff in broiler feed.

Table 3. Growth performance of broiler finisher birds fed diets containing treated sugarcane bark scrapping (4-8 weeks)

Levels of TSBS	Initial Weight IW(g/b/d)	Final Weight FW(g/b/d)	Feed Intake FI(g/b/d)	Weight Gain (g/b/d)	Feed convention Ratio	Feed Cost /Kg/W gain(₦)	Mortality (%)
0(%)	633.33	1415.19	102.46 ^a	27.92 ^a	3.67 ^a	529.76	0.33
7.5 (%)	631.66	1374.26	108.41 ^b	26.58 ^b	4.08 ^b	577.60	0.33
15(%)	628.00	1383.33	105.01 ^{ab}	26.60 ^b	3.95 ^b	540.85	0.10
SEM	4.0	46.4	2.1	1.3	0.1	24.7	0.2
Significance	NS	NS	S	S	S	NS	NS
Fermentation days							
4 days	631.11	1381.60	105.49	26.86	3.92	554.74	0.33
8 days	631.11	1400.24	105.11	27.27	3.85	544.06	0.22
SEM	3.2	37.9	1.7	1.1	0.5	20.1	0.2
L.O.S	NS	NS	NS	NS	NS	NSS	NS
Interaction							
0:4 days	633.33	1415.18	102.48	27.92	3.7	529.76	0.33
0:8 days	633.33	1415.18	102.48	27.92	3.7	529.76	0.33

7.5:4 days	630.00	1356.29	108.37	25.93	4.2	591.76	0.33
7.5:8 days	633.33	1392.22	108.46	27.23	4.0	563.51	0.33
15:4 days	630.00	1573.33	105.61	26.54	3.96	542.79	0.33
15:8 days	626.66	1393.33	104.40	26.66 ^a	3.90	538.92	0.00
SEM	5.7	65.7	3.0	1.9	0.2	34.9	0.4
L.O.S	NS	NS	NS	NS	NS	NS	NS

a, b means in the same column having different superscript are significant; SEM: Standard Error of the Mean. NS: Not significant, S: significant IW: Initial weight, FW: Final weight, FI: Feed intake, WT: Weight, FCR: Feed Conversion ratio, FC: Feed cost, TSBS: Treated sugarcane bark scrapping, L.O.S: Level of significant.

There was no significant ($P>0.05$) different observed in the different days of fermentation in all the parameters measured. Although 8 days' fermentation had higher value.

Mortality shows that there was no significant ($P >0.05$) different in all the dietary treatment and at different fermentation days.

The cost of feed consumed decreased as the level of TSBS increased in the diets. At 0% TSBS inclusion level, the cost of feed per kg was ₦143.16 while that of 7.5 and 15% inclusion levels were ₦140.88 and ₦136.84 respectively

The interaction on the other hand, there was no significant ($P>0.05$) different observed in the 0%:4 days, 0%: 8 days, 7.5%: 4 days, 7.5%: 8 days, 15%: 4 days and 15%: 8 days in all the parameter measured in the dietary treatment.

4. Conclusion

There is need for alternative feed materials such as treated sugarcane bark scrapping meal in feeding animals because of high cost of concentrate feedstuffs and high competition that exist between man and animal. All the birds remained healthy throughout the experiment. Although they have challenges of coccidiosis at early stage but was taken care of with embazine fort and it was controlled. Implying that consumption of diets with TSBS for twenty-eight days (four weeks) had no adverse effects on their health

The performance of broiler in the experiment showed that TSBSM was effective and efficient for the broiler birds. Mortality of birds in each experiment occurs once in each treatment group which was normal. The nutrient composition of TSBSM was recommended advantages to serve as an Alternative feedstuff to broiler chicken. It will be better if fermentation days will be left at 4 days since there was no significant difference observed in both 4 days and 8 days. This will save stress and time of fermentation. Based on the finding of this study also, 7.5% and 15% of TSBSM also performed well, but because of the dustiness and fibrous nature of TSBSM 7.5% was better to use to save stress and longer days of fermentation and drying TSBSM. furthermore, the cost was not left out. Also this study suggested that the use of SBS will not only serve as feed to livestock, recycling it will improve the sanitary condition of our environment.

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