

Growth performance of Savanna brown goats fed enzyme treated sawdust diets under intensive managed system

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Abstract

This study was conducted to determine the growth performance and correlation matrix of Savanna Brown goats fed enzyme treated sawdust diets managed intensively. A total of thirty (30) goats weighting between 5.2 and 5.3 kg were arranged in a completely randomized design. The animals were divided into five dietary Treatments (T) groups with three replications. Treatment one (1) comprises of animals fed 0 % enzyme treated sawdust while Treatment 2 (T2), Treatment 3 (T3), Treatment 4 (T4) and Treatment 5 (T5) comprises of animals fed 10, 20, 30 and 40 % enzyme treated sawdust diets, respectively. Data on growth performance parameters, body linear measurement (height at wither, body length, chest girth, hind leg length, fore leg length, facial length) were measured. Growth performance data were analyzed using one way analysis of variance. The results of growth performance reveled that animals fed 20 % and 40 % had significantly highest value, these trend was observed in total weight gain (T3 = 4900g and T5 = 4833g), average weight gain (T3 = 50g and T5 = 49.32g), total fed intake (T3 = 2956.20 and T5 = 2709.30g) and average feed intake (T3 = 211.16g and T5 = 193.52g). However, in feed conversion ration no significant difference was observed across all the treatment groups as the value range between 3.87 in animals fed 40 % to 7.12 in those fed 10 % enzyme treated sawdust diet. A positive and significant correlation was observed between body weight and chest girth with highest correlations in animals fed 20 % enzyme treated sawdust (0.97). It was therefore concluded that enzyme treated sawdust can be used in the diets of Savanna Brown goats up to 40 % replacement for maize offal for optimum performance

Keywords: sawdust diets, savanna brown goat, correlation matrix, growth performance

Introduction

Small ruminants, particularly, goats have been noted to play important role in animal protein production since they have the ability to convert forages, agricultural and industrial by products to useful body products (Banerjee *et al.*, 2009). However, in Africa, they are faced with poor nutrition, particularly, during the dry season (Ravhuhali *et al.*, 2011). This is because during these periods, animals suffer phases of starvation as an effect of scarcity and decrease in the nutrient contents of forages (Nwaigwe *et al.*, 2007). In times like these, most accessible ruminant feedstuffs turn out to be fibrous, with little nutrient and dry matter digestibility, thus, leading to poor

livestock production (Mubi *et al.*, 2008; Asaolu *et al.*, 2011). Processing some of these products might be a way of meeting up the nutrient gap during the dry season. Sawdust is the main by-product of wood processing in sawmills. It is, generally regarded as a waste, unless reprocessed into particle board, burnt in sawdust burner or used to make heat for other milling operations (Eze *et al.*, 2011). Sawdust if not properly handled may collect in piles and add harmful leachates into water systems and block the water ways, thereby, creating an environmental hazard (Eze *et al.*, 2011). Sawdust treatment may assist in degrading lignin, cellulose and hemicellulose to usable materials that can be utilized by

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ruminant animal (Belewu, 2006 and Akinfemi *et al.*, 2013). Feed enzymes have been used to improve a wide range of diets containing legumes, grasses, haylage, straw and other feedstuffs (Beauchemin *et al.*, 2003). The effect on enzyme treated sawdust is not fully understood. This experiment was therefore aim at determining the effect of enzyme degraded sawdust-based diets on the growth performance and correlation matrix of Savanna Brown goats under intensive management system.

Materials and methods

Location of the study

The study was conducted at the Teaching and Research Farm, and Laboratory of the Department of Animal Production, Federal University of Technology Minna. Minna is located in the Southern Guinea Savanna zone on latitude and longitude 9° 37 North and 6° 32 East, respectively, it has temperature ranges of 38 to 40 degree centigrade. Rainfall in Minna is between 1,200 and 300 mm. It an altitude of 1,475m above sea level with two (2) seasons of wet from April to October and dry from November to March (Climatemp, 2019).

Sources of sawdust and enzymes

Sawdust was obtained from saw mills located around Minna. It was sundried for 24 hours. The sawdust was sorted to remove unwanted particles before use. The enzymes (xylanase and cellulase) were prepared at the Department of Biochemistry laboratory of Federal University of Technology (Bosso campus), Minna, Niger State.

Experimental animals, management and designs

A total of thirty (30) Savanna Brown goats with an average weight of 5.26 kg were sourced from the University farm. Before the commencement of the study, the pens were thoroughly washed and cleaned using disinfectant (Izol) and allowed to dry for

one week. Ecto-parasites were checked using Ivermectin and pour on, while animals were dewormed internally using albendazole.

The goats were kept intensively where they were offered concentrate feed (300 g/goat) in the morning while in the evening roughage were offered (250 g/goat) as supplement. Feed were given to goats daily. The diets were offered at 4 % body weight, fresh water was provided *ad libitum*. This experiment lasted for four months.

Data collection

Growth performance

Live weight and body linear measurements of the goat were taken at the commencement of the experiment. Weekly mean live weights, feed intakes and liner body measurements were taken until termination of the experiment. Daily mean live weights and feed intakes were calculated from the weekly measurements. Feed conversion ratios were also calculated. Daily feed intake was measured by subtracting the leftover feed from the total feed given to the animals per head per day. Feed conversion ratio was calculated from feed consumed and weight gain for each replicate by dividing the weekly feed consumption value by the respective weight gains of the replicates for the week. This was determined from the weekly weight gained and feed consumption of each treatment as described by Anaeto *et al.* (2009) using the following formula:

$$\text{F.C.R} = \frac{\text{Average weekly feed intake (g)}}{\text{Average weekly weight gain (g)}}$$

Body weight and linear measurements

Body weight (kg) was taken using weighing scale. All linear measurements were carried out according to the procedure described by Adewumi (2014) using a measuring tape. Body length (BL) was measured as the distance from the external occipital protuberance to the base of the tail. Height-at-withers (HAW) was measured as the distance from the surface of a plat form to

the withers or measured on dorsal midline of the highest point on the withers. Chest girth (HG) was measured as body circumference just behind the fore legs. Facial length was measured as the distance from the centre of the poll (horn) to the tip of the upper lips. Hind limbs length was measured as the distance from hoof to the top of the pin bone. Fore limb length was

measured as the distance from the hoof to the crest of the shoulder.

Data analysis

All data collected were subjected to analysis of variance (ANOVA) using the computer software package SPSS 17.0 (SPSS, 2008). Difference among means was separated using Duncan's multiple range test.

Table 1: Composition of experimental diets (%)

Ingredients	T ₁ 0 % SDM	T ₂ 10 % SDM	T ₃ 20 % SDM	T ₄ 30 % SDM	T ₅ 40 % SDM
Maize	29.09	29.09	29.09	29.09	29.09
Maize offal	58.18	52.36	46.54	40.73	34.91
SDM	0.00	5.82	11.64	17.45	23.27
GNC	8.73	8.73	8.73	8.73	8.73
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100
Calculated analysis					
Energy (Kcal)	2819.19	2704.77	2590.35	2476.11	2361.69
Crude protein	13.44	13.30	13.16	13.02	12.87
Crude fibre	7.23	9.53	12.14	14.13	16.43
Ether extract	2.95	2.97	2.98	3.00	2.30
Lysine	0.23	0.23	0.23	0.23	0.23
Methionine	0.10	0.10	0.10	0.10	0.10
Calcium	1.14	1.14	1.14	1.14	1.14
Phosphorus	0.58	0.58	0.58	0.58	0.58

Results and discussions

Proximate composition of raw sawdust and enzyme-treated sawdust

The results of the proximate composition of raw and enzyme treated sawdust are presented in Table 2. The results indicate that crude protein content (9.45) and ash content (4.50) of enzyme-treated sawdust was higher than that of raw sawdust. However dry matter (71.60), crude fibre (50.00) and ether extract (5.65) of the enzyme-treated sawdust were lower than the raw sawdust. The value of crude protein (9.45) of enzyme treated sawdust obtained in this work is slightly higher to the value (8.80) obtained by Oke and Oke (2007). This implied that enzyme treated sawdust may be used as a source of protein in the diets of animals. The crude protein observed in this experiment is also higher than the crude protein value (2.7) obtained

by Hossain *et al.* (2012) who worked on estimated nutritive value of sawdust. The crude fibre and protein in the enzyme-treated sawdust is similar to those of maize offal and, thus, it can be used to replace maize offal in the diets of animals.

Proximate composition of experimental diets fed to savanna brown goats

Proximate composition of experimental diets is presented in Table 3. The dry matter was within the range of 96.00 (T₅) and 94.20 (T₂), the crude protein is within the range of 15.23 (T₃) and 14.23 (T₁). The crude fiber result content highest in T₅ (20.00) and lowest in T₁ (6.00). The nitrogen free extract and energy value reduces as the sawdust inclusion increases crude protein content of these diet ranges between 13 and 15 % which is slightly higher than the 12 % recommended value for goats (NRC, 2007).

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Table 2. Proximate composition of raw sawdust and enzyme-treated sawdust

Parameter (%)	Raw sawdust	Enzyme-treated sawdust
Dry Matter	92.60	71.60
Crude Protein	2.62	9.45
Crude Fiber	61.50	50.00
Ether Extract	16.70	2.00
Ash	4.02	4.50
Nitrogen Free Extract	16.70	5.65
ME (Kcal/kg)	1471.20	784.00

Table 3. Proximate Composition of experimental diets fed to Savanna Brown goats

PARAMETERS	0 % SDM	10 % SDM	20 % SDM	30 % SDM	40 % SDM
Dry matter	95.60	94.20	95.60	94.60	96.00
Crude protein	14.23	14.53	15.23	15.05	14.70
Crude fibre	6.00	7.50	16.81	15.00	20.00
Ash	10.50	10.45	10.26	11.46	11.28
Ether extract	3.84	4.28	4.46	3.98	4.71
NFE	61.03	57.44	48.84	48.11	45.31
Energy kcal/kg	3356.00	3264.00	2964.20	2884.60	2824.30

Keys

0 % SDM = 0 % Inclusion of enzyme -treated sawdust; 10 % SDM = 10 % Inclusion of enzyme -treated sawdust; 20 % SDM = 20 % Inclusion of enzyme-treated sawdust; 30 % SDM = 30 % Inclusion of enzyme-treated sawdust; 40 % SDM = 40 % Inclusion of enzyme-treated sawdust; NFE = Nitrogen Free Extract

Growth performance of savanna brown goats fed enzyme treated sawdust diet as replacement for maize offer managed under intensive system

Table 4 shows the results of growth performance of savanna brown goats fed diets containing varying levels of enzyme treated sawdust diets managed intensively. The results indicated that there was no significant ($p > 0.05$) difference in the initial body weight of animals among the treatment groups. There was, however, significant ($p < 0.05$) differences in the final weight (total weight gain daily weight gain. Animals fed 20 (10250.00 g) and 40 % (10083.00 g) enzyme treated sawdust meal had significantly higher values as compared to animals fed 0 (8050 g) and 30 % (7766.70 g) but statistically similar to those fed 10 %. The total feed intake and average feed intake for animals fed 20 and 40 % are statistically higher but can be compared statistically to animals fed 0 and 10 %, while, animals fed 30 % enzyme treated sawdust diets had significantly

lowest value than the other treatments. There was no significant ($p > 0.05$) difference in feed conversion ratio of experimental animals across all the treatment groups. The significant ($p < 0.05$) difference observed in the final weight, total weight gain and average daily weight gain in favour of goats fed 20 % and 40 % could mean that up to 40 % inclusion of enzyme treated sawdust in the diets of Savanna Brown goats is favourable. This agrees with the submission of Titi (2004) who reported significant difference in final body weight and daily weight gain when cellulase enzyme treated forage was given to Awassi lambs. Daniel *et al.* (2016) also reported significant difference in total body gain and average daily gain when they worked on effect of exogenous enzyme and application method on nutrient intake, digestibility and growth performance of Pelibuey lamb. The significant difference observed in total feed intake and average feed intake in this work disagrees with the work of Yashim *et al.* (2016) who reported

no significant difference in total feed intake and average daily weight gain of Red Sokoto bucks fed graded levels of dried sweet orange peel meal. However, the result is in line with the report of Ibrahim and Olofin (2013) who observed significant differences in feed intake and average daily weight gain of goats fed treated sawdust. Moniruzzaman *et al.* (2002) recorded

significant variations in in feed intake of Black Bengel goats in stall-fed goats, highest value in average live weight gain compared to those tethered, restricted grazing and grazing goats. Carlo *et al.* (2014) noted that with an increase in feed intake there was a corresponding increase in body weight gain.

Table 4: Growth performance of savanna brown goats fed enzyme treated sawdust diet as replacement for maize offal managed under intensive system

Parameters (g)	0 % SDM	10 % SDM	20 % SDM	30 % SDM	40 % SDM	SEM	p-value
Initial weight	5100.00	5283.30	5350.00	5316.70	5250.00	30.17	0.07
Final weight	8050.00 ^b	8833.30 ^{ab}	10250.00 ^a	7766.70 ^b	10083.00 ^a	301.05	0.01
Total weight gain	2950.00 ^b	3550.00 ^{ab}	4900.00 ^a	2450.00 ^b	4833.30 ^a	297.94	0.02
Average daily weight gain	30.10 ^b	36.22 ^{ab}	50.00 ^a	25.00 ^b	49.32 ^a	3.04	0.02
Total feed intake	2125.50 ^{ab}	2584.00 ^{ab}	2956.20 ^a	1751.40 ^b	2709.30 ^a	142.57	0.04
Average feed intake	151.82 ^{ab}	184.58 ^{ab}	211.16 ^a	125.10 ^b	193.52 ^a	10.18	0.04
Feed conversion ratio	5.89	7.12	4.52	5.00	3.87	0.58	0.46

ab = Means with different superscript are significantly (P<0.05) different

% SDM 0 % Inclusion of enzyme -treated sawdust; 10 % SDM = 10 % Inclusion of enzyme -treated sawdust; 20 % SDM = 20 % Inclusion of enzyme -treated sawdust; 30 % SDM = 30 % Inclusion of enzyme -treated sawdust; 40 % SDM = 40 % Inclusion of enzyme-treated sawdust; SEM = Standard error of Mean

Correlation matrix between body weight and body linear measurements of savanna brown goats fed diets containing enzyme treated sawdust diets and managed intensively

The correlation matrix between body weight and body linear measurements of Savanna Brown goats fed diets containing enzyme treated sawdust diets and managed intensively are presented in Table 5. There is high correlation between body weight and body linear measurement among the

treatment groups except for the control and animal fed 30 % enzyme treated sawdust diets that have negative correlation. However, the positive and significant correlations between body weight and chest girth observed in all treatment groups with the highest correlated in animals fed 20 % enzyme treated sawdust (0.97) indicates that chest girth can be used to predict live weight of animals and this agrees with most report of previous study like Mudala *et al.* (2016), Atta *et al.* (2004) among others.

Table 5: Correlation matrix between body weight and body linear measurements of Savanna Brown goats fed diets containing enzyme treated sawdust diets and managed intensively

PARAMETERS	0 % SDM	10% SDM	20% SDM	30% SDM	40% SDM
Body weight and height at withers	-0.20	0.65*	0.87**	-0.53	0.91**
Body weight and body length	-0.22	0.60*	0.84**	-0.31	0.92**
Body weight and chest girth	0.78**	0.86**	0.97**	0.62*	0.96**
Body weight and hind leg length	-0.08	0.64*	0.87**	-0.55*	0.90**
Body weight and fore leg length	-0.13	0.63*	0.85**	-0.48	0.93**
Body weight and facial length	-0.01	0.69**	0.90**	-0.31	0.93**

** Correlation is significant at 0.01 level (2-tailed) * Correlation is significant at 0.05 level (2-tailed)

Keys; 0 % SDM = 0 % Inclusion of enzyme-treated sawdust; 10 % SDM = 10 % Inclusion of enzyme-treated sawdust; 20 % SDM = 20 % Inclusion of enzyme -treated sawdust; 30 % SDM = 30 % Inclusion of enzyme -treated sawdust; 40 % SDM = 40 % Inclusion of enzyme-treated sawdust

Conclusions and recommendation

Based on the results obtained from this study, it can therefore be concluded that the replacement of enzyme treated sawdust in Savanna Brown goats' diets up to 40 % positively influenced the measurement of body weight and other body linear measurement. Goats fed 40 % inclusion of enzyme treated sawdust had their chest girth most correlated to body weight. Thus, chest girth can be used to predict body weight of Savanna Brown goats. Therefore, enzyme treated sawdust diets up to 40 % is recommended for Savanna Brown goats diets for better performance.

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