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Evaluation of multi-nutrient block supplementation on nutrient intake and growth performance of Yankasa rams fed based diet of cowpea shell and maize offal

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Abstract

The effects of supplementing different urea molasses blocks to Yankasa Rams fed maize offal-based diet on nutrient intake, growth performance and economics of production were evaluated. Yankasa rams fed cowpea shell and maize offal-based diets mixed in a ratio of 1:3 supplemented with urea molasses block (UMB). The supplementary blocks were formulated to contain 0, 5, 10 and 15% urea. Twenty Yankasa rams were used for the experiment with initial body weights range of 16-20kg and randomly allocated to four treatment groups of five animals each in completely randomized designed. Data on feed and water intake, body weight change were measured. Rams were fed both the basal diet and supplements ad libitum. The result revealed no significant (P>0.05) difference in basal feed (579.38-595.18g/day), UMB (60.78-96.50g/day) and dry matter intakes (584.36-609.33 g/day) among the treatments. Rams on treatment 3 recorded the highest average daily weight gain (ADG) and feed conversion ratio (FCR) (101.43 g/day, 5.93) than those on treatment 2 (48.57 g/day, 12.37) with the least. The cost of UMB/kg was least in treatment 3 (N 46.66) compared to those on treatment 1(N 83.66), 2(N 113.05) and 4(N 50.39). Supplementation of urea molasses block improved growth performance and FCR. Urea up to 15% may be included in urea molasses blocks without any detrimental effects on performance. However, including urea at 10% in UMB gave the highest ADG and FCR and therefore may be recommended for growing Yankasa rams.

Keywords: Performance, Yankasa rams, cowpea shell and maize offal

Introduction

Livestock production in developing countries is largely dependent on fibrous feeds mainly crop residues and low quality pasture that are deficient in crude protein, minerals and vitamins. These roughages are unbalanced in terms of nitrogen (N), mineral and vitamin content, and they are also highly lignified. Consequently, their dry matter (DM) digestibility is reduced. These characteristics keep voluntary dry matter intake (DMI) and productivity low, and consequently the quantity of animal products (meat, milk, and draught power, wool) is limited or nil (Bresciani and Valdés, 2007). Supplementation of poor-quality feeds with nitrogen sources increases the rate and extent of digestion resulting in improved dry matter intake (O' Donovan *et al.,* 1997). Non-protein nitrogen (NPN) sources such as urea and readily available energy sources such as molasses optimize rumen function *that can be used as alternative source to compensate for the nitrogen deficiency in fibrous feed.* Urea Molasses Multi-Nutrient Blocks (UMMB) are lick blocks containing urea, molasses, vitamins, minerals and other multi-nutrients. Urea molasses multi-nutrient urea block feed helps the growth of microorganism in the rumen, increases the digestion and consumption of fibrous feeds, allowing the animal to maintain, and often increase productivity of ruminant animals. (Mengistu and Hassen, 2017). According to Aye and Adegun (2010), production and use of UMMB is practiced in a number of countries and the result indicated that it improves the productive and reproductive performance of dairy cows and sheep. Several solutions have been suggested by researchers to improve the nutritional quality and palatability of low quality roughages. In this regards, combined feeding of low quality roughages with UMMB is considered to be one of the easiest and effective practices (Jayawickrama *et al.,* 2013). The objective of this study was to access the effect of urea molasses block (UMB) supplementation on nutrient intake, growth performance and economics of production Yankasa rams

Materials and methods

Description of the study area

The research was conducted at Abubakar Tafawa Balewa university Bauchi small ruminant research farm. The State spans two distinctive vegetation zones, namely the Sudan and Sahel Savannah. Bauchi State lays between longitude 9.0^0 and 12.3^0 north of the equator and latitude 8.5^0 and 11^0 east of the Greenwich meridian according to Bauchi state government diary (BASGD 2006).

Formulation of urea molasses block

The composition of urea molasses block (UMB) used in this experiment is presented in (Table 1). UMB were prepared by a cold mixing process and the mixture was poured into specially designed frame and mould constructed at the center for industrial studies of ATBU Bauchi to form blocks weighing 1 kg each. The sizes of the frame and mould were 25cm x 20cm x 45cm and15cm x 10cm x 15cm (L x W x H). The UMB contained molasses, urea, wheat offal, bone meal, cement, salt and water. The supplementary blocks were formulated to contain 0, 5, 10 and 15% urea respectively. Urea was added to molasses, stirred and left standing overnight. Next morning, the rest of the ingredients were mixed together on a polythene sheet. To obtain a uniform distribution in the whole premix, common salt, being the smaller quantity, was mixed with bone meal before mixing with the other dry ingredients. The urea-molasses mixture was poured into this premix and mixed thoroughly by hand. Water was smeared on the internal side of the mould for easy removal of the cast blocks, 1kg of semi-solid (mixed material) was weighed and put into the metal mould then covered with a wooden sheet tightly fitting the mould. Pressure was applied by using hydrolic jack 5 tones for 20–30 seconds to shape the block. Moulding equipment was opened and the block is removed for drying. The blocks were air dried under shade for 21 days and became ready for feeding

Table 1: Composition of urea molasses blocks (%)

Ingredients	Treatments			
	T1	T2	T3	T4
Molasses	46	41	36	31
Urea	0	5	10	15
Wheat offal	38	38	38	38
Cement	8	8	8	8
Bone meal	2	2	2	2
Salt	2	2	2	2
Water	4	4	4	4
Total	100	100	100	100

T1-0% urea, T2-5% urea, T3-10% urea, T4-15% urea

Experimental animals and management

Twenty (20) Yankasa rams were used for the experiment. The rams were purchased from different markets in Bauchi environs and quarantined for 21 days. They were drenched with anti-helminthic (albendazole suspension) against internal parasites, iverrmectin injection for both internal and external parasites and a broad spectrum antibiotic oxytetracycline.

Experimental design

Following the quarantine period, the initial body weights of all animals were measured with a ranged of 16-20kg (averaged 17.2kg) and randomly allocated to four treatment groups with five animals each in completely randomized designed. The rams were kept in well ventilated individual pens in (1.0 x 1.8 m^2) equipped with watering and feeding troughs, identified with neck collars. Animals were accustomed to the pens for 10 days before the start of experiment. Animals were given UMB without urea 0% (treatment 1), UMB with urea 5% (treatment 2), UMB with urea 10% (treatment 3) and UMB with urea 15% (treatment 4) for 70 days. All animals in each group received UMB and basal diet (cowpea shell and maize offal) mixed in the ratio of 1:3 ad libitum and had free access to clean water. Weekly body weight changes were recorded before feeding. The amounts of blocks licked and refusals were recorded after 24 hours consumption.

Chemical analysis

All samples of supplements (UMB) and basal diet were analyzed for DM, OM, ash, nitrogen (N), according to the procedures of AOAC (1990). Crude protein (CP) was calculated as N*6.25. Crude fibre (CF), neutral detergent fiber (NDF) and acid detergent fiber (ADF) were analyzed as per the procedure of Van Soest and Robertson (1985).

Statistical analysis

Data obtained were subjected to ANOVA in a completely randomized design using the MINITAB 16 (2014). The treatment means were separated using least significant difference (LSD)

Results and discussion

Chemical composition of experimental feeds

The nutrient and chemical compositions of basal diet and UMB are presented in Table 2. The DM content of basal diet 89.68% was comparable to 85.96% reported by Tiwari et al. (2012) for seasonal fodder +concentrate mixture at 1% body weight and 91.83% reported by Aganga et al. (2005) for veldt grass. The observed CP content of the basal diet was higher than 9.29% CP reported by Aganga et al. (2005) and 5.18% CP reported by Tiwari et al. (2012). A low CP of 9.46% was also reported by Rafiq et al. (1996). The NDF and ADF content of the experimental basal diet were higher than that reported 36.27% and 25.27% by Aganga et al. (2005). DM content of supplement (88.16-91.24%) (UMB) was comparable to the DM of 90.79% reported by Geleta et al. (2013). The observed DM was higher than 85.63% which was reported by Tiwari et al. (2012), likewise contrary to that reported 93.21% by Aganga et al. (2005). CP content of 10.91%, 12.43% and 14.48% was reported by Onwuka (1999) which was lower than the observed in treatment 2, 3 and 4 with similar inclusion level of urea at 5%, 10% and 15%. This variation may be as the result of rice bran used instead of wheat offal as fibre source of the block. High CP content of 28.59% was reported by Aganga et al. (2005) at 15% urea level of inclusion which is contrary to this study of 20.55% at the same level of urea inclusion in treatment 4. ADF content of 25.41% lower than observed and NDF content of 33.11% was reported by Aganga et al. (2005) which is not in consistent with this study in treatment 4 having urea 15% level of inclusion. Lower NDF and ADF of 29.08% and 13.53% than the observed was reported by Geleta et al. (2013).

Table 2 : Nutrient and chemical compositions of basal diet and UMB

Nutrient (%)	Treatments				
	T1	T2	T3	T4	Basal diet
Dry matter	91.24	89.16	88.34	88.16	89.68
Organic matter	83.54	82.69	82.59	82.61	82.63
Crude protein	9.5	13.56	16.63	20.55	12.63
NDF	47.11	45.23	42.11	40.16	52.53
ADF	38.67	34.54	32.11	30.69	43.51
Hemicellulose	8.44	10.69	10	9.47	9.02
Ether extract	0.54	0.48	0.42	0.36	0.61
Ash	6.89	6.13	5.64	5.23	6.96

T1-0% urea, T2-5% urea, T3-10% urea, T4-15% urea Neutral detergent fibre-NDF, acid detergent fibre -ADF

Feed intake and growth performance

Table 3 shows the daily feed intake, dry matter intake (DMI) and growth performance of Yankasa rams fed basal diet supplemented with urea molasses blocks. No significant (P>0.05) difference was observed in basal diet and supplement intake between all the treatments. The total feed intake in g/d was similar in all the treatments which ranged (652.64-672.78 g/day). The basal diet intake (579.38-595.18 g/day) was similar to that reported (538.82-608.92 g/day) by Aganga *et al*. (2005) in Tswana sheep in Botswana fed veldt grass. Supplement intake were similar in this study (60.78-96.50g/day) which is consistent with 72.3g/day block intake reported by Tiwari *et al*. (2012). It is also in conformity with the recommendation of Ethiopia sheep and goat productivity improvement program (ESGPIP, 2007) that the quantity of blocks fed to sheep and goat should be limited to 100 g/day. High block intake of 198 g/day was reported by Geleta *et al*. (2013) in sheep fed on natural pasture. The DMI in this study ranged from 584.36 to 609.33 g/day, which concurred with cumulative DMI range of 40.05 to 46.95 Kg reported by Muralidharan *et al*. (2015) for Mecheri lambs fed green and dry fodder. Block intake of 129 g/day was also reported by Unal *et al.* (2005) in lamb fed with Barley straw which is contrary to the observed value in this study. Block intake of 95.25 to 105.85 g/day was reported by Guesh *et al*. (2014) by black head Ogaden sheep fed hay in Ethiopia. The DMI % body weight which is the quantity of DM consumed by the animal in relation to its body weight was significant (P<0.05) between the treatment groups in the current study. Highest percentage of 2.93% was recorded in animal supplemented with treatment 2 while those on treatment 3 with the lowest 2.48%. The DMI % body weight of 2.30% was recorded by Hossain *et al*. (1995) which is not in consistent with the observed ranged (2.48 to 2.93%). There was no significant (P>0.05) difference **in the** initial weigh of the experimental animals. Final body weight gain (WG), average daily weight gain (ADG) and feed conversion ratio (FCR) were significantly influenced by the supplements. Animals on supplemented treatment 3 record the highest (WG) of 7.10 kg, with (ADG) of 101.43 g/day while animals on treatment 2 with the lowest 3.40 kg WG and ADG of 48.57 g/day. Higher FCR of 5.93 was recorded for animal on treatment 3 while animal on treatment 2 with the least of 12.37. This may be implied that animals on treatment 3 better utilized their feed than those on other treatments. Final body weight, weight gain and average daily weight were significant (P<0.05). Higher weight change of 7.1 kg was recorded in this study which is closer to 8 kg reported by Aganga *et al*. (2005) in animals supplemented with UMB containing 10% urea level of inclusion. Weight change of 4.85 kg was recorded in a study conducted by Muralidharan *et al*. (2015) which is consistent with this study. Average daily weight gain of 68.57 g/day in this study was similar to 67g/day recorded by Aganga *et al*. (2005). In another study by Geleta *et al*. (2013) weight gain of 85.77 g/day was reported. Feed conversion ratio was similar to that report by Muralidharan *et al*. (2015) which record low FCR in treatments with low weight gain and similar DMI with other groups.

Economic analysis

There were no significant (P>0.05) differences observed in the total block intake and total costs of block consumed between the treatment groups throughout the experimental period. Significant (P<0.05) difference were recorded in block cost/Kg weight gain as shown in Table 4.

Table 3 : Feed intake, dry matter intake and growth performance of Yankasa rams supplemented with UMB

Parameters	Treatments				LSD
	T1	T2	T3	T4	
Basal feed intake (g/day)	581.28	579.38	595.18	591.86	NS
Supplement intake (g/day)	96.50	91.36	77.72	60.78	NS
Total feed intake (g/day)	677.78	670.74	672.90	652.64	NS
DMI (g/day)	609.33	601.04	602.41	584.36	NS
Initial body weight (Kg)	17.50	17.10	17.20	17.30	NS
Final body weight (Kg)	22.30^{ab}	20.50^{b}	24.30^{a}	22.50^{ab}	2.23*
Weight change (Kg)	4.80^{ab}	3.40^{b}	7.10^{a}	5.20^{ab}	2.02*
Average daily weight gain g/day	68.57^{ab}	48.57^{b}	101.43^{a}	74.29^{ab}	28.92*
Dry matter intake % body weight	2.73^{b}	2.93^{a}	2.48^{d}	2.60^{c}	0.39*
Feed conversion ratio	8.88^{c}	12.37^{d}	5.93^{a}	7.86^{b}	2.01*

T1-0% urea, T2-5% urea, T3-10% urea, T4-15% urea, dry matter intake-DMI, LSD- Least significant difference ^{a,ab,b,c} Means within each row with different superscripts are significantly different,*(P<0.05), NS-not significant

Table 4 : Economic analysis of supplemental feeding

Parameters	Treatments				LSD
	T1	T2	T3	T4	
Total weight gain (Kg)	4.80^{ab}	3.40^{b}	7.10^{a}	5.20^{ab}	2.02*
Total block Intake (Kg)	6.76	6.39	5.44	4.25	NS
Cost /kg of block in ₦	59.4	60.15	60.90	61.65	NS
Total block cost (₦)	401.54	384.36	331.30	262.01	NS
Block cost /Kg weight gain (₦ /Kg)	83.66^{b}	113.05^{a}	46.66^{c}	50.39^{c}	27.93*

T1-0% urea, T2-5% urea, T3-10% urea, T4-15% urea, LSD- Least significant difference
^{a,ab,b}Means within each row with different superscripts are significantly different* (P<0.05) NS -not significant

The cost of production of 1kg of block ranged N 59.40-61.65. No significant (P>0.05) difference were observed in the total block intake and total costs of block consumed between the treatment groups throughout the experimental period which ranged from 4.25-6.76 kg to N 262.01- N 401.54. Significant (P<0.05) differences were recorded in block cost/Kg weight gain. Highest block cost/kg weight gain was recorded in animals on treatment 2 (N 113.05) while those on treatment 3 with the least cost (N 46.66)

Conclusion

Based on the result of the trial, inclusion of urea in block at 10% gave the best performance of Yankasa rams with concomitant reduction in the cost of supplement and therefore may be recommended for growing Yankasa rams.

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