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Urea-molasses block supplementation on nutrients digestibility of Yankasa rams fed maize stover

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Abstract

Sixty (60) days of feeding trial was conducted to determine the nutrients digestibility of Yankasa rams fed maize Stover as basal diet, seven (7) days adaptation period for twelve growing Yankasa rams aged between 9-12 months was carried out and were subjected to four (4) dietary treatments with three (3) replicates in a completely randomized design (CRD). The four treatments were, T_1 (Maize Stover only (control), T_2 (molasses 36%, rice offal 43%, urea 5%, cement 7% salt 9% and basal diet)), T_3 (molasses 26%, rice offal 43%, urea 15%, cement 9% salt 7% and basal diet) and T_4 (Molasses 40%, rice offal 39%, urea 10%, cement 4% salt 7% and basal diet), to determine feed intake, growth rate, rumen Nitrogen-ammonia (NH_3-N) content and PH, the results of dry matter digestibility ranges from 11.22%-67.01%, crude protein digestibility ranges from 78.96–91.97%, fat digestibility ranges from 96.22–97.23%, crude fibre digestibility ranged from 10.32–28.39%, ash was from 51.66–59.56%. The result shows higher concentration of Ammonia (mg/mol) in T_4 (19.97mg/100ml), and the lowest was recorded in T_1 (14.95mg/100ml). The rumen pH as observed in all the treatments were within the range of 7.15-8.00 with T_4 as the highest and T_2 having the lowest, these results showed no significant difference at ($P>0.05$) between the treatments groups. The study revealed that rams in treatment (T_2) generally gave a significant difference ($P<0.05$) higher performance in terms of dry matter intake and live weight gain. From the results obtained in this study, urea-molasses treatment of maize stover improved crude protein contents and digestibility, consequently, an economic decision had been proved in the used of urea-molasses treated maize stover as an animal feed which improved the nitrogen (protein) contents of the treated Stover, energy and soluble carbohydrate. The use of urea-molasses treatment is safe, economical, socially acceptable, and environmentally friendly and can be applied easily on the farm with high probability of being adopted by farmers.

Keywords: Urea; Molasses; Maize Stover; Yankasa Rams

1. Introduction

The productivity of small ruminants in the tropics and subtropics is mainly based on feeds from native pastures, crop residues and edible parts of shrubs and trees, which are generally high in fiber and low in crude protein (CP) as well as in Metabolizable energy (ME) (Cherdthong, 2009). Feed intake and the nutrients absorption from such diets are insufficient to meet the nutritional requirements of the animals and are prone to lose weight without additional supplements (nitrogen, energy and mineral) (Ramírez, *et al*., 2007). Supplementation of low quality diets with forage legumes or grains has been reported to increase intake, digestibility and growth performance. Among the major factors limiting the productivity of small ruminants in developing countries are the over-dependence on low digestible feeds which at certain periods of the year cannot meet even the maintenance requirements of these animals, the incidence of tsetse fly is another factor affecting the production and distribution of livestock. Cattle, sheep and goat distribution in

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Nigeria are limited by tsetse fly incidence and the availability of forage. The semi-arid ecological zone of Nigeria is virtually tsetse fly free, but has the lowest forage resources. Over 70 % of the total population of livestock in Nigeria is concentrated in the guinea and Sudan zones (Gefu, 2002). Ugwu (2007) reported that the problems of small ruminants' producers were disease, feed, accommodation constraint, inadequate capital, destructive habit of the animals and predators, among others. Nigeria was estimated to have a population of 41.3 million sheep, 72.5 million goats and 19.5 million cattle (FMARD, 2016). Small ruminants rearing in Nigeria like in any other places are important in supporting the livelihoods of poor resource farmers throughout the developing world.

2. Materials and Methods

2.1. Location of the Study

The experiment was conducted in the Ministry for livestock production premises. The area is located in Yola North Local Government Area of Adamawa State and lies within the Northern Guinea Savanna between latitude 7^{o}N and 11^{o}N and longitude 11^{o}E and 14^{o}E of the equator.

Table 1 Formulations of Four (4) Different Experimental Diets

Ingredients		**Treatments**		
	T_1	T_2	T_3	T_4
M O (Basal diet)	BD only%	BD %	BD %	BD %
Molasses	-	36	26	40
Rice offal	-	43	43	39
Urea	-	5	15	10
Cement	-	7	9	4
Salt	-	9	7	7

Key: MO: Maize offal. BD: Basal diet.

2.2. Preparation of Molasses-Urea Block

The materials used for the preparation of molasses-urea blocks included molasses a bi-product of sugar cane after the extraction of sugar from the sugar factory, obtained from Savannah Sugar Company Numan, Adamawa state. Nigeria, rice offal as one of the major materials was obtained from a rice mill, urea, salt and cement were procured from a local market. 22 x 19 x 15 cm dimensions wooden mould was constructed; weighing scale for weighing of ingredients and diets

2.3. Experimental Diets

Maize stover was harvested from my farm, dried and chopped to 3cm length particles size, the Stover was packed into a 100kg bag and stored for feeding the animals; the stover was fed as basal diet, while the three different formulations of blocks served as supplements fed at intervals. Table 1 contained the formulations of the four (4) different experimental diets offered to the animals; The quantity of different ingredients in the supplements were carefully measured using a measuring scale and were added together in a particular order of magnitude during the preparation of the experimental diet.

2.4. Feeding of experimental animals

Sixty days feeding trial was carried out with four treatments and three replicates T_1 T_2, T_3 and T_4 respectively, shelters were provided for the rams to minimize heat intensity. the rams were adopted for two weeks, Maize stover was offered as a basal diets placed inside their feeding trough for all the rams; the blocks were given to each individual ram and were replaced when exhausted The basal diet and the supplements were weighed in the morning at 8.00 hours and then at 16.00 hours in the evening, the next morning left over feeds were weighed and recorded, Water was measured using a 100ml cylindrical flask and was offered to the rams, the quantity left over were also measured and recoded before fresh water was allocated, the treatments were laid using Completely Randomized Design (CRD).

2.5. Digestibility

At the end of a feeding trial, twelve rams were confined in a metabolic cage, four treatments with three replicates, one ram per replicate. The rams were fed with experimental diets and water for a period of 14 days to get adapted to the environment and also for rumen microbes to adjust on the feed. After the adaptation period faeces from each ram was collected for 21 days (McDonald *et. al*, 1998.) faeces were sun dried grind, samples of the faeces were taken to the department of animal science laboratory for proximate analysis to determine the percentage of nutrients in each sample according to AOAC (2014).. Percentage of digestibility was carried out using the formula below.

$$\text{Percentage digestibility } = \frac{\%\text{ Nutrient of feed } - \%\text{ Nutrient of feaces}}{\%\text{ Nutrient of feed}} \times 100$$

3. Results and discussion

Table 2 Chemical Composition (%) of Experimental Diets

Nutrients	Treatments			
	T_1	T_2	T_3	T_4
Dry Matter (DM)	81	89.5	92.0	89.5
Crude Protein (CP)	1.8	13.6	12.5	13.6
Crude Fibre (CF)	36	11	10	10.0
Ash	8	25.5	21.5	7.5
Nitrogen Free Extract (NFE)	34.9	38.9	41.7	53.9
Lipids	0.5	0.5	0.5	4.0

Key: T_1 = Maize Stover only (Basal diet), T_2 =Basal diet and block (Molasses 36%, Rice offal 43%, Urea 5%, Cement 7%, Salt 9%), T_3= Basal diet and block, (Molasses 26%, Rice offal 43%, Urea 15%, Cement 9%, Salt 7%,) T_4 =Basal diet and Block (Molasses 40%, Rice offal 39% Urea 10%, Cement 4% and Salt 7%)

Table 3 Nutrients Digestibility of Yankasa Rams Fed Different Formulation of Urea -Molasses Blocks

Parameters	Treatments				
	T_1	T_2	T_3	T_4	LSD
Dry matter %	11.22	67.01	59,46	30.09	2.679**
Crude protein	78.96	91.97	87.73	90.31	0.1708*
Lipid	96.22	97.23	96.53	96.87	6.909**
Fibre	10.32	28.39	18.87	21.89	2.094**
Ash	55.44	54.87	59.56	51.66	1.6418*
NFE	31.29	44.47	36.57	65.37	8.7156*

Key:** = Highly significant at P< 0.01, * = Significant at P < 0.05.NFE=Nitrogen Free Extract, LSD=Least Significant Difference, %= Percentage.

3.1. Nutrients Digestibility

Dry matter digestibility (DMD) table, showed the highest dry matter digestibility was obtained in treatment two while the lowest was in treatment one. The dry matter digestibility values in rams fed urea–molasses blocks revealed that supplementation do not really affect digestibility across the treatments means, this agreed with the findings of Adams *et al*. (1995) that ammonia or supplementation has no effect on dry matter digestibility but tended to increase digestibility of the diet. Urea-Molasses blocks contained urea as source of nitrogen for the microbes and this was mostly the source of ammonia in the diet, from analysis the ammonia content in the urea-molasses block falls within the ranged values of 55.5–70.9mg/100ml which is the acceptable requirements for the rumen microbes to function (Mudzengi, *et al*., 2014).

3.2. Crude protein digestibility

The highest crude protein digestibility was observed in treatment two (91.97%) while the lowest was recorded in treatment one (78.96%). The results obtained in this study were within the ranged values as reported by Yahaya *et al.* (2001) that supplementation increases crude protein digestibility. The urea-molasses block formulation in treatment two had 89.5DM and 13.6CP as compared to treatment one with 81%DM and 1.8%CP and this agreed with the report by Yahaya *et al*, (2001) that the quantity of the available nutrients in the supplement greatly influenced the digestibility.

3.3. Crude fibre digestibility

The result revealed that treatment two have the highest value of 28.39% and the lowest value was recorded in treatment one (10.32%). This result agrees with the submission of Owen (1993) who reported increased crude fibre digestibility with supplementation, this can be observed in the formulation of treatment two, treatment three and treatment four as compared to treatment one where supplementation reduced fibre content in all the treatments except in treatment one (Chumpawadee, *et al;* 2007).

3.4. Nitrogen free extract digestibility (NFE)

From table 3 the nitrogen free extract digestibility ranged from treatment four (65.37%) to treatment one (31.29%). The value of nitrogen free extract digestibility tends to increase with the incorporation of molasses protein supplementation as reported by Ibrahim (2007). The composition in treatment two, treatment three and treatment four revealed a higher percentage of molasses and urea as compared to treatment one (control) no supplementation and that might have contributed to the higher values nitrogen free extract digestibility (Chantiratikul, (2007).

Table 3 Rumen Ammonia, Nitrogen (NH_3-N) Concentration and pH of Yankasa Rams Fed different Composition of Urea-Molasses Blocks

Parameters	**Treatments**			
	T_1	T_2	T_3	T_4
Ammonia mg/100ml	54.9	62.5	69.5	77.3
Ammonia mg/10ml	14.95	16.19	17.95	19.97
Ph	7.50	7.15	7.25	8.00

Key: T_1 = Maize stover only (Basal diet), T_2 =Basal diet and block (Molasses 36%, Rice offal 43%, Urea 5%, Cement 7%, Salt 9%), T_3= Basal diet and block, (Molasses 26%, Rice offal 43%, Urea 15%, Cement 9%, Salt 7%,) T_4 =Basal diet and Block (Molasses 40%, Rice offal 39% Urea 10%, Cement 4% and Salt 7%)

3.5. Rumen ammonia nitrogen concentration (NH_3-N) and rumen pH

The highest rumen NH_3-N concentration was obtained in treatment four and the lowest in treatment one. The ammonia nitrogen (NH_3-N) concentration agrees with the range given 15–20 (mg/10ml). This can be observed in the treatments, where treatment one with no supplementation had 14.95mmol/l as compared to treatments two, three and four that had higher supplementation values in the diet. The higher pH was recorded in treatment four and the lowest was recorded in treatment two, the pH concentration in treatment two do not falls within the range 6.2–7.0 as reported by Orskov and Ryle (1998), which further stated that cellulolytic bacteria needed pH within that range in order to multiply for feed conversion in the rumen.

Recommendation

The result obtained revealed that urea-molasses blocks can effectively be used as maintenance ration for rams during the dry season. Crop residues (maize stover) can efficiently be combined with supplements such as urea-molasses blocks to at least prevent animals from losing weight during the dry season.

4. Conclusion

Urea-molasses treatment of maize stover improved crude protein contents of the treated stover, digestibility, energy and soluble carbohydrate, which is safe, economical, socially acceptable, and environmentally friendly. Farmers will have the knowledge of improving lignified stover and other fibrous crops residues/by products, reduced feeds cost and increase livestock productivity during the dry season when there is constant seasonal fluctuation of herbage Other studies should be carried out to determine toxic inclusion levels of urea and molasses block in sheep feeds.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Human consideration for the well-being of the animals were considered and the conducts of all the procedure involved, there are no alternative to the use of animals possible, number of animals used were minimized and unnecessary duplication was avoided.

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