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THE GROWTH PERFORMANCE OF YANKASA RAMS FED GAMBA GRASS (*ANDROPOGON GAYANUS*) AND VARIOUS LEVELS OF ENSILED UREA TREATED GROUNDNUT SHELL MEAL SUPPLEMENTARY DIET

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ABSTRACT: *This study was carried out to investigate the feed intake, nutrient intake, and growth performance of Yankasa rams fed gamba grass (Andropogon gayanus) and various levels of ensiled urea treated groundnut shell meal supplementary diet. A total of twenty (20) growing Yankasa rams aged between 7 and 8 months with an average body weight of 11.50 kg were used for this experiment. Five treatment groups were established, with varying levels of UTGSM supplementary diet (0%, 5%, 10%, 15%, and 20%). Parameters such as organic matter, crude protein, fiber, ether extract, ash, NFE (nitrogen-free extract), concentrate, and forage intake were measured. Average total weight gain and average daily weight gain were also determined. The results showed significant variations in nutrient intake among the treatment groups. The results showed that animals on T5 with 20% UTGSM inclusion in their supplementary diet had the highest feed intake, nutrients intake and growth performance compared to the other treatments. It was concluded that 20% level of UTGSM inclusion could replace maize offal 100% in the supplementary diet of Yankasa rams to improved feed and nutrients intake, and growth performance. It was recommended that livestock producers can incorporate up to 20% of UTGSM into small ruminants feed in order to reduce the cost of production especially during the dry season.*

KEYWORDS: Urea treated, nutrients intake, growth performance.

INTRODUCTION

Feed scarcity is one of the major constraints to livestock production in the West African Sub-region (Glatzle, 1992). There is a shortage of conventional animal feed because food grains are required almost exclusively for human consumption. Poor quality roughages comprise a huge part of the feed available to ruminants for a considerable part of the year (Preston & Leng, 1987). The poor quality of the feed resources available to ruminants results in low plane of nutrition with attendant low productivity of our indigenous animals (Otaru *et al*., 2011).

Osinowo *et al*. (1991) observed that small ruminants play a key role in bridging the wide gap between requirement and supply of animal protein for human consumption because of their special features such as relatively short generation interval (compared to cattle), high reproductive rate and low production cost. Given the estimated population of 34.5 million goats and 22.1 million sheep in Nigeria (Abdu *et al*., 2012), small ruminants have a vital role to play in mitigating the acute animal protein shortage of the country.

Kibon and Ørskov, (1993) observed that the main feed resources for ruminant animals are pastures, crop residues and other agro-industrial by-products. In the dry season and post-harvest periods, these feed resources become the main sources of energy for ruminants when poor quality forages prevail. The quantity and quality of available feedstuffs are major factors influencing productivity of ruminants in many parts of the world, especially regions with high populations of livestock. Ruminants in such areas depend largely on crop residues during the long dry periods of the year for maintenance as well as for the production of meat, milk, skin and fibre. However, animal performance with such feedstuffs can be poor due to low voluntary intake and digestibility, which result from low protein concentrations and high levels of indigestible or slowly degradable fibre (Abdel Hameed *et al*., 2013).

It is well established that in Nigeria, there are plenty of groundnut shells (GNS), with an average of 1018 kg/ha produced annually (Larbi *et al*., 1999), which are either burned or left on the farm to rot as they are regarded as waste. However, in the recent past, burning has received global condemnation and therefore the need for its conversion to a feed resource (Akinfemi, 2010).

Feeding value of low quality fibrous feeds can be improved through various biological, physical, and chemical treatments. Among various chemicals employed for upgrading fibrous feeds is the use of alkali proved to be better (Khan *et al*., 2006). However, where small farms predominate, treatment with a urea solution followed by a period of storage under ensiled conditions may be more convenient. Treatment of crop residues with urea has three primary interrelated benefits, namely increased nitrogen concentration, feed intake and nutrient digestibility (Abdel Hameed *et al*., 2013). Supplementing low quality forage-based diets with N sources elevates ruminal ammonia N concentration to provide rumen bacteria with their requirements such as pH (near neutral); optimum temperature, etc. to achieve maximum rates of fermentation (Abdel Hameed *et al*., 2013).

Sarnklong *et al*. (2010), in their study on improving fibre utilization following treatment with alkalis, suggest that scope exists to derive more nutrients from fibre by microbial fermentation in the rumen. However, potentially degradable fibre may be transported from the rumen before fermentation could be complete. The extent of fermentation in the available time depends on the number of cellulolytic bacteria (Zulkarnaini *et al*., 2012). Treated groundnut shells for

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feeding livestock will provide cheap and readily available feed resources among rural communities where groundnut production is predominant, while making the environment better by removing the waste material.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Sheep and Goat Unit of the Livestock Teaching and Research Farm, Joseph Sarwan Tarkaa University, Makurdi, Benue State, Nigeria. It is located within the Guinea Savanna Zone. It lies between latitude 8°50' North and longitude 11°31' East of the equator. The state is characterized by a tropical climate marked by dry and rainy seasons. The rainy season usually commences in the month of March and ends up in October. The dry season then starts in late October and ends in March. The annual rainfall is between 1000 and 1500 mm with an average minimum temperature of 30°C and maximum temperature of 38°C depending on the season (TAC, 2009).

Experimental Animals and Management

A total of twenty (20) growing Yankasa rams aged between 7 and 8 months with an average body weight of 11.50 kg were used for this experiment. The animals were purchased from the livestock market in Lafia Local Government Area of Nasarawa State. The animals were given prophylactic treatment and quarantined for two weeks prior to the commencement of the experiment, dewormed with Albendazole 5 ml/20 kg orally, and injected with Oxytetracycline L.A 1ml/10kg (im) and Ivermectin 0.3 ml/25kg (sc). The rams were also given intramuscular application of Multivat at the dosage of 1 ml/10 kg body weight. The rams were housed in demarcated individual pens with concrete floors. The floor of the pens was covered with wood shavings before the arrival of the sheep.

Collection and Preparation of Test Ingredient

The groundnut shells were obtained from the Groundnut Processing Unit in Ujam Community, Makurdi. The groundnut shells (GNS) were grinded using a hammer mill fitted with a 2.5 cm screen. Five percent (5%) urea solution was prepared by dissolving 5 kg of urea in 95 liters of water. Two hundred kilograms (200kg) of the grinded GNS was soaked in the urea solution and allowed to ferment for 7 days, after which the water was squeezed out with the use of a sack and applying force. Thereafter, the mixture was ensiled using rubber containers to cover properly with black polythene sheets to ensure an anaerobic condition for the microorganisms for 21 days. The ensiled ammoniated groundnut shell meal was dried under the sun until it was completely dried.

Experimental Feed

Five (5) experimental diets were formulated and compounded for the animals containing graded levels of urea treated groundnut shell meal: T1 = no urea treated groundnut shell (UTGNSM), T2 = contains 5% urea treated groundnut shell meal (UTGNSM), T3 = contains 10% urea treated groundnut shell (UTGNSM), T4 = contains 15% urea treated groundnut shell (UTGNSM) and T5 = contains 20% urea treated groundnut shell (UTGNSM). Other

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ingredients in the complete diets were maize offal, palm kernel cake (PKC), rice bran, brewers dried grain (BDG), bone ash and salt as presented in Table 1.

Experimental Design

Completely randomized design (CRD) was adopted for the experiment in which the rams were divided into five treatment groups of four rams each after balancing for weight, and each group was randomly allocated to one of the five dietary treatments. The basal diet (Andropogan gayanus) and the experimental diets were fed to ram once daily. About 500 g of Gamba grass (Andropogan gayanus) were offered every morning (9.00am). The experimental diets were fed to the animals at 4% of their body weight 2 hours after. Drinking water was also provided ad libitum. The feeding trial lasted for a period of eight weeks (56 days).

Data Collection

The initial weight of the animals were measured by using a weighing scale at the beginning of the feeding experiment and thereafter weighed weekly. Feed intake (FI) was determined by subtracting the leftover feed from the quantity of feed served. The average daily feed intake (ADFI) was determined by dividing the total feed consumed by the number of animals multiplied by days of the experiment.

Chemical Analyses

Homogenous samples of test diets were analyzed for proximate compositions as outlined by AOAC (2005). Gross energy (GE MJ/kg) was calculated using the equation recommended by MacDonald *et al*. (2011) as shown below:

GE (MJ/kg) = 0.0226CP + 0.0407EE + 0.0192CF + 0.0177NFE

Statistical Analysis

An analysis of variance (ANOVA) for completely randomized design (CRD) was used to determine whether they were significant differences in variables measured among the experimental groups using the statistical package for social sciences (SPSS) (version 20.0). Where significant differences occurred, means were separated using Duncan’s Multiple Range Test (DMRT).

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RESULT AND DISCUSSION

Result

Table 2 shows the results on chemical composition of the experimental diets: dry matter content range from 91–94.29%, the crude protein content range from 13.13–13.56%, the crude fibre contents range from 13.19–25.51%, the Ash content (4.08–18.62%), and the ether extracts (EE) (3.93–5.43%). The result of the feed intake and nutrient intake of Yankasa ram fed gamba grass (Andropogon gayanus) and various levels of ensiled urea treated groundnut shell meal is presented in Table 3. The results showed a significant (P<0.05) difference in feed intake and nutrient intake among the treatment groups. The organic matter intake was highest in T5 (20% EUTGSM) and lowest in T2 (5% EUTGSM). Crude protein intake followed a similar trend, with T5 having the highest intake and T2 having the lowest. Fiber intake was highest in T5 and lowest in T1 (0% EUTGSM). Ether extract intake was highest in T1 and lowest in T4 (15% EUTGSM). Ash intake was highest in T5 and lowest in T1. NFE intake showed a decreasing trend with increasing levels of EUTGSM inclusion, with T1 having the highest intake and T4 having the lowest. Concentrate intake was highest in T5 and lowest in T4. There was no significant (P>0.05) difference in forage intake among the treatments.

The growth performance of the rams fed the experimental feeds are shown in Table 4. The results show that there was a significant (P<0.05) difference between treatment groups for total weight gain (TWG), total feed intake (TFI) and average daily feed intake (ADFI). However, there is no significant (P>0.05) difference between the treatment groups for initial weight (IW), final weight (FW) and average daily weight gain (ADWG). The feed conversion ratio (FCR) was lowest for T5 (6.26) and highest for T4 (10.8).

DISCUSSION

The results on chemical composition showed that the ensiled basal diet had a dry matter content of (91–94.29%), which is comparable to the DM (88.16–91.24%), reported by Yerima *et al*. (2020) when the author evaluated multi-nutrient block supplementation on nutrient intake and growth performance of Yankasa rams fed based diet of cowpea shell and maize offal. The DM contents in this experiment were higher than the values recorded by Inuwa *et al*. (2020) when the authors fed cattle fore-stomach digesta ensiled with locust bean pulp and NPN to Uda rams. The crude protein content of experimental diet (13.13–13.56%) were within the range (9–14%) recommended as minimum requirements for maintenance and production for animals and indeed ruminants (Aduku, 2005) and higher than the value (12.6%) recommended by Yerima *et al.* (2020) for supplementary diet. The crude protein content of the concentrate diets were high enough to meet the optimum microbial need in the rumen. The crude fibre contents value (13.19–25.51%) were comparable to the CF contents (22.29 to 26.09%) observed by Ashiru *et al*. (2017) when growing Yankasa sheep were fed complete ration containing different inclusion levels of ensiled sugarcane waste and poultry litter. It may be inferred that urea treatment was effective in the hydrolysis of the fibrous structure of GNS to release available nutrients capsuled within the cell, as reported by Adamafio *et al*. (2012) when maize stalks and wheat straw were immersed in alkali, and the degradation of the cellulose fraction was exceedingly effective. The ash content increased progressively with increase in the levels of UTGSM in the diets and was higher than the value of 5.4% reported by Yerima *et al*. (2020),

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comparable to the ash content (11.75%) obtained by Yakubu *et al*. (2017). This means that higher vitamins and minerals were made available with the inclusion of the UTGSM in the diets. The ether extracts (EE) (3.93–5.43%) were also comparable to the EE content (2.90 to 4.79%) reported by Adebisi *et al*. (2020).

The UTGSM inclusion level (20%) in the diet of animals on T5 in this study resulted in increased crude protein intake, indicating improved nutrient availability. This is in agreement with various authors (Abdel Hameed *et al*., 2013; Gunun *et al*., 2013; Wanapat *et al*., 2013) who reported that by treating crop residues with urea or calcium hydroxide or both along with true protein supplementation, intake and degradability can be enhanced, compared to feeding untreated crop residues alone. It could also be due to the protein quality and quantity in the UTGSM which might have enhanced fermentation activities of rumen microbes, which in turn improved protein intake (Fadiyimu *et al*., 2010; Ochepo *et al*., 2015).

The crude fiber intake by animals on T5 was significantly ($P<0.05$) higher than the other treatments. Fiber is an important component of the diet of a ruminant animal. Without adequate fiber in the diet, normal rumination does not occur. In sheep, feeding a concentrate-based diet with limited amounts of fiber results in “wool pulling” as the animals seek a roughage source. To promote a healthy rumen, the dietary fiber content generally should be greater than 50% (Darrell *et al*., 2012). Ether extract intake differs significantly ($P<0.05$) with T1 having the highest intake followed by T5. From this study, Ether extract intake decreased with increased combination of maize offal and UTGSM. However, intake increased when maize offal was completely replaced by UTGSM in the diet of animals on T5. This could be as result of negative associative influence of the two feeding ingredients in the diets T2, T3 and T4 as observed by MacDonald *et al*. (2011), who reported that mixed diets and those containing smaller particles recorded marked reduction in digestibility per unit increase in feeding level ranging from 0.02–0.03 and attributed this to negative associative effects which become pronounced at higher levels of feeding. A similar trend was observed for NFE intake which also decreased with increasing levels of EUTGSM in the mixed diets, indicating a decrease in carbohydrate intake.

The concentrate feed intake in this study shows a significant ($P<0.05$) difference among the treatments. However, intakes by animals on T1 and T5 were not significantly ($P>0.05$) different, which suggests that maize offal can be replaced 100% by UTGSM.

The values recorded for the growth performance of Yankasa rams in this study show that total feed intake (TFI) was highly significant ($P<0.05$); however, TFI values for animals on T1 and T5 (25.42 kg and 24.22 kg respectively) were not significantly ($P>0.05$) different. The results also revealed that there was a significant difference for total weight gain (TWG) and average daily feed intake (ADFI). However, there was no significant ($P>0.05$) difference in the values recorded for rams on diet T1 and T5 (3.13 kg and 3.88 kg) and (453.63 g and 432.56 g) respectively. The higher weight gain recorded by animals on T5 may be an indication of a better nutrient utilization from the UTGSM. This suggests that the level of supplementation with ensiled urea treated groundnut shell meal diet was adequate (Khan *et al*., 2017). It may also be as a result of a better nutrient absorption and utilization by the rams diet T5 (20%) which resulted in a higher total weight gain and daily weight gain as compared to those fed diet T2 (5%), T3 (10%) and T4 (15%%) (McDonald *et al*., 2011). The decreased feed intake and low weight gain observed in animals on T2, T3 and T4 in this study was similar to the findings of Millam (2020) when they fed Urea treated groundnut shell along with maize offal in a complete diet to Yankasa rams. The high feed intake in the animals receiving 20% UTGNSM

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diets (T5) in this study was in consonance with the findings of Abdel Hameed *et al*. (2013) and Kade (2020) who reported that lambs fed treated GNS had increased feed intake. This may be as a result of the increased palatability of the diet due to supplementation with high fermentable carbohydrates and protein which improved the nutritive value of the feed (Melaku *et al*., 2004). Lower intake in the group of rams fed diet containing T2 (5%), T3 (10%) and T4 (15%) might be attributed to animal differences of feed acceptability (Huyen *et al*., 2012). Higher weight gain observed in animals on T5 was similar to the value reported by Kade (2020) who fed treated groundnut shell to ram-lambs and reported the highest daily weight gain in the group of animals fed lime treatment.

The feed conversion ratio (6.26) for animals on T5 was the best compared to the other treatments and is similar to the value reported by NRC, (2007). A feed conversion ratio (FCR) (kg feed dry matter intake per kg live mass gain) for lambs is often in the range of about 4 to 5 on high concentrate rations, 5 to 6 on some forages of good quality, and more than 6 on feeds of lesser quality (NRC, 2007). Other things being equal, FCR value tends to be higher for older lambs (e.g., 8 months) than younger lambs (e.g., 4 months) (NRC, 2007). This means that when the poor quality status of feed materials for ruminants are improved (either through treatment or supplementation or any other means) to reduce lignin concentration, efficient feed utilization will improve growth.

CONCLUSION AND APPLICATIONS

1. The result of this study shows that maize offal and UTGSM should not be used together to compound a supplementary diet for Yankasa sheep since the inclusion of both maize offal and UTGSM in the diets of animals on T2, T3 and T4 had negative associative effects which affected the feed and nutrients intake, and growth performance of the animals on these diets.
2. Maize offal 100% should be replaced at 20% level of UTGSM inclusion in the diet, improved feed and nutrients intake, and growth performance of Yankasa sheep.
3. Livestock producers can incorporate up to 20% of UTGSM into small ruminants feed in order to reduce the cost of production especially during the dry season.

FUTURE RESEARCH

Further research will be carried out to study the effect of higher levels of ensiled urea treated groundnut shell meal inclusion in supplementary diets for Yankasa rams and other breeds of sheep and goats.

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Table 1: Percentage Composition of Experimental Diet

	Levels of inclusion (%)				
Ingredient	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	T5 (20)
UTGNSM	0	5	10	15	20
Maize Offal	20	15	10	5	0
BDG	20	20	20	20	20
Rice Bran	35	35	35	35	35
PKC	20	20	20	20	20
Bone Ash	4	4	4	4	4
Salt	1	1	1	1	1
TOTAL	100	100	100	100	100

UTGNSM = Urea treated groundnut shell meal, BDG = Brewers Dried Grain, PKC = Palm Kernel Cake, T1 = Treatment 1, T2 = Treatment 2, T3 = Treatment 3, T4 = Treatment 4 and T5 = Treatment 5.

Table 2: Proximate Composition of Experimental Diets

Parameters	T1	T2	T3	T4	T5
DM	91.67	94.29	94.09	93.99	93.84
CP	13.61	13.51	13.33	13.37	13.41
CF	13.19	16.24	19.36	22.43	25.51
Ash	4.80	8.23	11.66	15.65	18.52
EE	5.43	4.50	5.09	4.52	3.93
NFE	63.69	57.27	50.56	44.63	38.53
GE MJ/Kg.	1.909	1.814.	1.775	1.707	1.635

DM = Dry matter, CP = Crude protein, CF = Crude fibre, EE = Ether extract and NFE = Nitrogen free extract.

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Table 3: Feed Intake and Nutrient Intake of Yankasa Ram Fed Gamba Grass (*Andropogo ngayanus*) and Various Levels of Ensiled Urea Treated Groundnut Shell Meal in Supplementary Diet

Parameters (g)	T1(0%)	T2(5%)	T3(10%)	T4(15%)	T5(20%)	SEM
Organic matter	812.16^{a}	697.11^{b}	664.38^{b}	645.57^{b}	829.19^{a}	18.69
Crude protein	109.09^{a}	93.09^{b}	87.72b	85.53^{b}	110.35^{a}	2.75
Crude Fiber	165.14^{b}	161.79^{b}	161.36^{b}	167.83^{b}	221.95a	5.47
Ether extract	30.58^{a}	20.96^{c}	20.78^{c}	18.68^{c}	24.39^{b}	1.03
Ash	44.93^{c}	49.44^{c}	60.89^{b}	60.89^{b}	101.96^{a}	4.69
Nitrogen Free Extract	429.21^{a}	356.05^{b}	317.64^{c}	299.13^{d}	345.65^{b}	10.40
Concentrate	453.40^{a}	301.49^{b}	286.46^{b}	249.86^{b}	432.58^{a}	23.66
Forage	422.81	445.10	419.40	444.12	453.51	6.27

abc = mean across rows with different superscripts are significantly (P<0.05) different.

Table 4: Performance of Yankasa Ram Fed Graded Levels of Ensiled Urea Treated Groundnut Shell Meal in Supplementary Diet

Parameters	T1	T2	T3	T4	T5	SEM
IW (kg)	11.50	11.50	11.38	11.50	11.63	0.46
FW (kg)	14.63	13.75	13.13	13.00	15.50	0.48
TWG (kg)	3.13^{a}	2.25^{b}	1.75^{b}	1.50^{b}	3.88^{a}	0.23
ADWG (g)	55.80	40.18	31.25	26.78	69.19	4.10
TFI (kg)	25.42^{a}	16.89^{b}	16.04^{b}	13.99^{b}	24.22^{a}	1.32
ADFI (g)	453.63^{a}	301.55^{b}	286.47^{b}	249.86^{b}	432.56^{a}	26.65
FCR	8.61	7.55	9.27	10.8	6.26	0.63

ab mean across rows with different superscripts are significantly (P<0.05) different. IW = Initial weight, FW = Final weight, TWG = Total weight gain, ADWG = Average daily weight again, TFI = Total feed intake, ADFI = Average daily feed intake and FCR = Feed conversion ratio.

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