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Nutritional Evaluation of Alkali Treated Neem Kernel Cake Fed to Fattening Uda Rams

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Abstract: The study was conducted to evaluate the growth performance and nutrient digestibility of fattening Uda rams fed Alkali treated neem kernel cake. The experiment was conducted at the Teaching and Research Farm of Usmanu Danfodiyo University. Sixteen Uda rams were randomly allotted to treatment diets A, B, C and D with 0, 8.33, 16.67 and 24.99% levels of inclusion of ATNKC, respectively. The study lasted for 105 days consisting of 84 days feeding trial and 21 days of digestibility trial which comprised of 14 days for adaption and seven days for collection of feaces. The dry matter digestibility for all the nutrients in the control and test diets was comparable. The performance of the sheep in treatment B recorded the best ADG of 166.67g/day and highest dry matter intake in treatment A. It was recommended in the study that alkali treated neem kernel cake can be safely included in feed of sheep up to 24.99% for the rams.

Key words: Uda lambs, Alkaline treated neem kernel cake, azadirone and nimbin

INTRODUCTION

Ruminant production plays an important role in livestock production. In northern Nigeria where the majority of livestock in the country are found, the livestock industry is being faced with the problem of inadequate feed supply to the animals especially during the late dry season periods (from December/January to June/July) and animals' requirement for energy and protein are not usually met (Oyenuga, 1968; Adegbola, 2004). The rapid increase in human population has been accompanied by a deficit in concentrate feeds available to livestock (Musalia *et al*., 2002) and this always results in low levels of performance. It is therefore necessary to look for alternative sources of feed ingredients in order to optimize animal performance (Maigandi, 2001).

The neem seed cake could fit in as one of the alternative sources of feed ingredients. The protein in the cake is relatively balanced in its amino acid content and mineral profile (Gowda and Sastry, 2000). However, despite the high nutrient content, it could not achieve a universal acceptability due to its pungent smell and bitter taste as a result of the presence of some agents: azadirone, nimbin and salanin as noted by Elangovan *et al.* (2000), hence the need for finding ways of masking these agents to improve its acceptability by the animals. Therefore, the present study tended to find out the performance of fattening rams fed varying levels of alkali treated neem kernel cake.

MATERIALS AND METHODS

The study was conducted at the Livestock Teaching and Research Farm of the Usmanu Danfodiyo University, Sokoto. The farm is located within the main campus of the University at about 10 kilometers North of Sokoto metropolis in Wammako Local Government Area of Sokoto State. The farm is located within the main campus of the University at about 10km North of Sokoto metropolis in Wammako Local Government of Sokoto state.

Sixteen entire male Uda rams were purchased from village markets in Sokoto state for the experiment. The animals were quarantined for two weeks and group fed within the Teaching and Research Farm. The animals were balanced for weight with 26.38kg in treatments A and C; and 26.25 kg in B and C. They were dewormed with Banmth IIR dewormer (12.5g/kg) body weight, sprayed against ectoparasites with triatic and treated with oxytetracycline (a broad-spectrum antibiotic) administered by intramuscular injection.

The ingredients used for preparing experimental diets were alkali treated neem kernel cake, cotton seed cake, rice milling waste, cowpea husk, wheat offal, cowpea haulms, salt and bone.

The ripe fruits were dried by spreading them in the sun for fifteen days. The dried fruits were cleaned and soaked in water for three days and then depulped. The depulped seeds were washed and sun dried for a

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period of ten days. The dry seeds were decorticated, further dried for five days, crushed and the oil removed manually to produce the neem kernel cake. The cake was treated with Sodium Hydroxide (NAOH) by soaking the cake in water (w/v 1:1.5) in which 20g NAOH/kg cake wt/wt was dissolved for 24 hours. This was followed by sun drying and grinding.

Four complete experimental diets were formulated for this study. Treatment A was the control diet without inclusion of neem kernel cake. Treatments B, C and D consisted of 8.33, 16.33 and 24.99% level of alkali treated neem kernel cake respectively.

Experimental animals were housed in individual pens measuring 2×1m. The pens were cleaned and disinfected. A Completely Randomized Design (CRD) was used in the experiment. Sixteen male Uda rams were used for the experiment. They were divided into four treatment groups of four animals. The rams were balanced for body weight for the experimental diets and were fed *ad libitum* with the experimental diets at 7.00hr and 16:00hr everyday for 84 days.

The feeding pens were cleaned and disinfected a week before the commencement of the experiment. Each pen was provided with feeding and water trough big enough to allow for sufficient drinking and feeding without waste. The feeding and water troughs were cleaned every morning before feeding. Water was offered *ad libitum*. The animals were weighed at weekly intervals between 8.00am and 9.00am, after an overnight fasting throughout the period of the experiment. Daily records of feed intake were taken throughout the twelve weeks of feeding by weighing feed offered and the leftover the following day in the morning.

At the end of the feeding trial, a digestibility study was conducted using three animals from each treatment. The animals were fed the same experimental diets used in the feeding trial. The digestibility trial lasted for 3 weeks i.e. (2 weeks for adaptation and one week for faecal collection). Harness and faecal bags were used to collect the faeces and these bags were fitted after the first seven days of the adaptation period so that the animal will be familiar with it before collection. During the collection period, daily feed intake was recorded. Total faecal output from each animal was recorded also. After thorough mixing, 5% of the faeces was sampled and transferred to plastic containers. The samples were oven dried for dry matter determination and stored until required for analysis.

Thoroughly mixed representative samples of the four experimental diets and feacal samples were analyzed for chemical composition as outlined by AOAC (2000). The data generated was subjected to analysis of variance (ANOVA) using Completely Randomized Design (CRD) according to Steel and Torrie (1980). Where significant differences between the treatment means were indicated, Duncan Multiple Range Test (DMRT) was used to separate the means (Duncan, 1955) using Statistical Package for Social Sciences (SPSS).

Table 1: Ingredient Composition of the experimental diets

Ingredients	DIET (%)			
Ingredient	A	B	C	D
ATNKC	-	8.33	16.67	24.99
Maize	10	8	5	2
Cowpea Haulms	16	10	7	2.01
CSC	26	16.67	7	-
Wheat Offal	10	10	9	2.5
Cowpea Husk	19	20	25.33	30
Rice Milling Waste	17	25	28	36.5
Bone Meal	1	1	1	1
Salt	1	1	1	1
Total	100	100	100	100

Diet A: 0% level of ATNKC inclusion; Diet B: 8.33% level of ATNKC inclusion; Diet C:16.67% level of ATNKC inclusion; Diet D: 24.99% level of ATNKC inclusion

RESULTS

Proximate composition of experimental diets: The chemical composition of the experimental diets are presented in Table 2 with the dry matter ranging from 96.30% in treatment A to 96.70% in treatment C. Crude protein value was highest in treatment B (13.07) and lowest in treatment D (13.01%). The ether extract increased from C (6.20%) to B (6.60%). For crude fibre, the value ranged from 25.50% in treatment B to 26.20% in treatment D. For Nitrogen free extract, treatment A (43.27%) was the highest while treatment D (42.72%) was the lowest. The Ash content of treatments ranged from 11.67% in treatments A to 12.10% in treatment B.

3.2 Live-weight Changes by the Fattening Rams.

Table 3 shows the result of growth performance of the fattening rams. The average daily weight gain was higher in treatment B (166.67g/day) but significantly similar (P>0.05) to treatment A (141.37g/day). Treatments C and D were not significantly different (P>0.05) from treatment A. The average daily gain increased by 17.90% from treatment A to B, decreased by 6.32% and 15.79% in treatments C and D respectively. Feed intake and dry matter intake was significantly higher (P<0.05) in treatment A (1320.25g and 1271.25g, respectively) than other treatments. The dry matter intake decreased from treatment A to

Table 2: Proximate Composition of the experimental diets (%)

Parameters	Treatments			
	A	B	C	D
Dry matter	96.30	96.50	96.70	96.60
Crude protein	13.02	13.07	13.03	13.01
Ether extract	6.50	6.60	6.20	6.40
Crude fibre	25.60	25.50	25.60	26.20
Nitrogen free extract	42.98	42.73	43.27	42.72
Ash	11.90	12.10	11.90	11.67

Table 3: Live weight Changes by the fattening rams

	Treatments				
Parameter	A	B	C	D	±SE
Initial Weight(kg)	26.38	26.25	26.25	26.38	1.51
Final Weight(kg)	38.25	40.25	37.38	36.38	1.20
Weight Gain(kg)	11.88^{ab}	14.0^{a}	11.13^{b}	10.0^{b}	0.80
Average Daily gain(g)	141.37^{ab}	166.67^{a}	132.44^{b}	119.05^{b}	9.55
Feed Intake(g)	1320.25^{a}	1132.75^{b}	1057.50^{b}	1063.75^{b}	46.30
Dry matter intake(g)	1271.25^{a}	1117.25^{b}	998.25^{b}	1026.50^{b}	41.74
Dry matter intake as % body weight	3.29^{a}	2.75^{b}	2.73^{b}	2.82^{ab}	0.16
Feed gain ratio	9.04^{a}	6.71^{b}	7.77^{ab}	8.77^{a}	0.56

Means not followed by the same superscripts are significantly different (P<0.05) along the row

Table 4: Feed intake by fattening

	Treatments				
Parameter	A	B	C	D	±SE
Crude Protein intake(g)	165.51a	145.93b	130.08b	136.28b	5.97
Protein efficiency	0.86^{b}	1.14^{a}	1.02^{ab}	0.87^{b}	0.06
Crude Fibre intake(g)	325.43^{a}	284.91^{b}	255.56^{b}	274.02^{b}	9.69
Ether extract(g)	82.63^{a}	73.74^{ab}	61.90^{c}	66.97^{bc}	2.97
Nitrogen free extract	546.36^{a}	477.47^{b}	481.87^{b}	438.63^{b}	17.86

Means not followed by the same superscripts are significantly different (P<0.05) along the row

treatments B, D and C by 12.11, 19.25 and 21.48%, respectively. Dry matter intake as percentage of body weight gain in treatments A and D were not significantly different (P>0.05). However, treatments D, B and C were not significantly different (P>0.05) from each other. Treatment A was significantly higher (P<0.05) than treatments B and C. The feed efficiency of treatment B (0.15) was not significantly higher (P>0.05) than treatment C (0.14) but was significantly higher than treatments A and D. Feed gain ratio in treatments A (9.04), D (8.77) and C (7.77) were similar (P>0.05). While treatment B was significantly lower (P<0.05) than treatments A and D, it was similar (P>0.05) to C.

Feed intake by the fattening rams: From Table 4, Crude protein intake in treatment A (165.51g) was significantly higher (P<0.05) than treatments B (145.93), D (136.28g) and C (130.08g). For protein efficiency, treatment B (1.14) was similar (P>0.05) to treatment C (1.02) but significantly higher (P<0.05) than treatments D (0.87) and A (0.86). Crude fibre intake was significantly higher (P<0.05) in treatments A (325.43g) than other treatments which were similar (P>0.05). The ether extract intake in treatments A (82.63g) was similar (P>0.05) to treatment B (73.74g) but significantly higher (<0.05) than other treatments. Treatment B was similar (P>0.05) to treatment D but significantly higher (P<0.05) than treatment C. The Nitrogen free extract intake in treatment A (546.36g) was significantly higher (P<0.05) from other treatments which were similar (P>0.05).

Nutrient digestibility of the fattening rams: Table 5 shows that the dry matter digestibility of treatments B (72.69%), A (71.05%) and C (67.82%) were not significantly different (P>0.05). Treatments B and A were significantly higher (P<0.05) than treatment D while treatments C and D did not differ significantly (P>0.05). The crude protein digestibility in treatments A, B and C did not differ significantly (P>0.05) between each other but were all significantly higher (P<0.05) than the values in treatment D. For ether extract, the digestibility in treatments B (72.38%), A (68.97%) and C (61.66%) were similar (P>0.05). Treatments B and A were significantly higher (P<0.05) than treatments D while treatments C and D did not differ significantly (P>0.05) between each other. The nitrogen free extract digestibility followed the same trend with crude fibre digestibility.

DISCUSSION

Characteristics of the experimental diets: The crude protein level of this study varied from 13.01% in treatment D to 13.07% in treatment B. This was higher than the values reported by Church (1978). He reported (11%) as protein requirement for fattening lambs weighing 30 to 55 kg. The higher level of CP in this study was due to the high level of CP in ATNKC. The high level or crude protein could have influenced a higher intake of feed. Chriyaa *et al.* (1997) reported that high CP and low CF levels increase voluntary feed intakes. The crude fibre ranged from 25.50% in treatment B to 26.20% in treatment D, this is comparable to the estimated CF range of 22% to 25% by Ganovsk and Ivanov (1982) for ruminants. The ether extract varied from 6.20% in treatment D to 6.60% in treatment B was higher than the ether extract range of 4.30% to 5.50% by Maigandi

Table 5: Nutrient Digestibility of the fattening rams

	Treatments				
Parameter	A	B	C	D	±SE
Dry matter digestibility	71.05[a]	72.69[a]	67.82[ab]	54.76[b]	4.01
Crude protein digestibility	83.08[a]	79.59[a]	76.11[a]	66.80[b]	2.74
Ether extract digestibility	68.97[a]	72.38[a]	61.88[ab]	51.41[b]	3.32
Nitrogen free extract digestibility	72.03[a]	72.02[a]	68.01[ab]	54.73[b]	4.26
Crude fibre	71.81[a]	70.15[a]	64.39[ab]	51.60[b]	4.49

Means not followed by the same superscripts are significantly different (P<0.05) along the row; Funding: The study was self sponsored

(2001) when he fed fore-stomach digesta to fattening rams but with similar range of nitrogen free extract.

Performance characteristics of experimental animals: The feed intake in this study was higher in the control diet than in the treatment diets. The inclusion of ATNKC and reduction in the level of cowpea hay could have been responsible. The palatability could also been a contributing factor. This is in contrast with the report of Reddy (1992) in which feeding of ATNKC at 30 parts of inclusion in concentrate mixtures for buffalo calves for 150 days revealed comparable feed intake.

The Average Daily Gain (ADG) in the test diets compared favourably with the control diet. Animals on treatment B performed better than those on treatment A, though not significantly different (P>0.05). Abil *et al.* (1992) reported ADG of 53 to 148g when cotton seed and maize were replaced with wheat bran in diets of Yankasa sheep. Adu and Brickman (1981) reported ADG values of 78 to 183g when Uda sheep were fattened with varying levels of Guinea corn and groundnut cake with Digitaria smutsii hay as a source of roughage. The adequate level of CP, EE and CF in the diets could have contributed to the animals' performance. The encouraging performance of the animals on the test diet is supported by the report of Reddy and Rao (1988b) in which treatment of neem kernel meal with alkali improved the growth performance. It also conformed to the report of Anandan *et al.* (1999) when goats were fed urea ammoniated neem kernel cake. The encouraging ADG obtained in the result of the fattening study could partly have been as a result of balancing of the nutrients and comparable feed efficiency in the control and test diets. The nutrient digestibility of the control and test diets was comparable especially in the control diet and treatments B and C. These could have influenced the trend of the ADG. The ADG could also have been as a result of the effectiveness of the detoxification with sodium hydroxide as reported in a similar study by Anandan *et al.* (1999).

Conclusion: The result of the study revealed a comparable performance of animals on the control and test diets. Alkali treated neem kernel cake inclusion in feed of sheep up to 24.99% for fattening sheep, respectively is recommended. This will help in alleviating the problem of scarcity of feeding stuff and reduce the cost of production during the dry season of the year.

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