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Growth performance and economics of sheep production with varying levels of rice milling waste

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Abstract

A twelve-week feeding trial was conducted using sixteen (16) growing Uda lambs to determine the growth performance of sheep fed varying levels of rice milling waste. Diets containing graded levels of rice milling waste replacing wheat offal at 15, 30 and 45% inclusion levels were formulated. Diet without rice milling waste served as control. Results showed that incorporating rice milling waste in the diet of growing sheep up to 45% level did not adversely affect (P>0.05) growth performance. Such incorporation led to decrease in the cost of feed /kg live-weight gain. However, animals on 30% rice milling waste diet were better compared to other treatments in terms of dry matter intake, weight gain, and cost of production. For best economic returns, rice milling waste in the diet of the growing sheep should not exceed 30%. Finally, it is recommended that more trials should be carried out with different breeds of sheep in order to ascertain the true feeding value of rice milling waste.

Key words: Growth, Rice milling waste, Uda sheep.

Introduction

Nutrition is one of the most important environmental factors affecting sheep production in the tropics (Devendra, 1988; Nuru, 1982). Competition between humans and animals on available grains make it difficult to meet the nutritional requirements of animals at reasonable costs. The high cost and seasonality of feeds have stimulated the search for alternative feed resources that can economically supplement the conventional feed ingredients in rations without adverse effects on health and performance of animals (Smith, 1988; Lufadeju and Olorunju, 1986).

Rice milling waste is an agro-industrial by-product found in large quantities in Sokoto. Rice bran (as rice milling waste) was analysed and found to contain 11. 5% crude protein, 2100 kcal/ ME energy and minerals such as calcium and phosphorus required for animal growth (Abubakar, 2003). The main objective of the study is to determine the growth performance of Uda sheep fed varying levels of rice milling waste. Specifically, the study will determine the dry matter intake, body weight gain and efficiency of feed utilization of growing sheep fed rice milling waste diet and determine the economics of feeding rice milling waste to the animals.

Materials and Methods

Location of Experiment

The study was conducted at the Usmanu Danfodiyo University, Sokoto Livestock Teaching and Research Farm. Sokoto has a semi-arid climate, characterized by low rainfall low humidity and high solar radiation with minimum and maximum temperatures of 13 and 42 OC reported in January and April respectively.

Due to low humidity, Sokoto is known to be more suitable for livestock production than for any other form of agricultural production. However, the major constraint of the region is inadequate availability of feed and drinking water especially during the dry season.

Experimental Animals and their Management

Sixteen (16) entire male Uda lambs with an average weight of 19.5 kg were purchased from village markets around Sokoto. The animals were quarantined in the Teaching and Research Farm of the Usmanu Danfodiyo University for four weeks; dewormed with Banmith II® (12.5mg/kg body weight), sprayed with Triatrix® against ecto-parasites and treated with oxytetracycline HCL (a broad spectrum antibiotic). Prior to the commencement of the experiment, the animals were managed intensively and group-fed with cowpea hay and wheat offal.

Experimental Feed Preparations

Rice Milling Waste

The principal ingredient, rice milling waste was purchased from rice processing areas in Sokoto metropolis. The rice milling waste was sun dried on large tarpaulin sheets. It was turned daily to ensure uniform drying and to eliminate maggot development. The advantage of sun drying is to enhance diet formulation, eliminate protozoa and fungi as well as reduce bacterial contamination.

Other Feed Ingredients

Other feed ingredients that were used in the preparation of the experimental diets include cotton seed cake, cowpea husk, bone meal, wheat offal and maize. Bone meal was obtained from burnt bones at Sokoto central abattoir. Other feed ingredients were purchased from Sokoto Central Market.

Experimental Diet Formulation

Four complete experimental diets were formulated using varying levels of rice milling waste to replace wheat offal at 0, 15, 30, 45% inclusion levels (Table 1) and were designated as diets 1, 2, 3 and 4 in the experiment. The composition of the experimental diets is shown in Table 1. Variation in composition of some feed ingredients (as observed from Table 1) was made in order to balance up the crude protein and energy levels.

Table 1

Composition of the experimental diets

Ingredients (%)	Rice milling waste inclusion (%)			
	1 (0)	2 (15)	3(30)	4(45)
Rice milling waste	0	15	30	45
Wheat offal	45	30	15	0
Maize	5	5	5	5
Cotton seed cake	15	19	24	30
Cowpea husk	14	10	7	5
Groundnut haulms	20	20	18	14
Salt	0.5	0.5	0.5	0.5
Bone meal	0.5	0.5	0.5	0.5
Total	100	100	100	100
Calculated C.P.	16.32	16.29	16.28	16.29
Calculated energy (kcal/kg)	2066.00	2149.70	2221.10	2280.20

Experimental Design and Feeding Procedure

A complete randomized block experimental design (Steel and Torrie, 1980) was used in this experiment with number of animals representing replicates and graded levels of rice milling waste representing treatments. Four (4) animals were allocated to each treatment and were balanced for weight. Each animal was housed in a pen measuring 2m x 1m x 2m, which had been previously disinfected. Each group was assigned to one of the experimental diets and fed ad libitum in the morning and evening for 90 days. Water and salt lick were also offered ad libitum.

Data Collection

The animals were weighed prior to the commencement of the experiment and every week on the same day of the week between 8.00 and 9.00 am after feed withdrawal for 14-16 hours to avoid error due to gut-fill. Daily record of feed intake was taken throughout the 90 days feeding trial.

Sanitation and Health Management

Faeces and urine were removed every day from the feeding pens to ensure adequate ventilation, less ammonia accumulation, adequate cleanliness of the experimental pens and minimum discomfort of the experimental animals.

Sampling and Analytical Procedure

Thoroughly mixed representative samples of the experimental diets and rice milling waste were analysed for proximate composition as outlined by the Association of Official Analytical Chemists

(AOAC, 1990). Acid Detergent Fibre (ADF) was analysed in the samples as reported by Ranjhan and Krishna (1980).

Statistical Analysis

The data generated from the experiment was subjected to analysis of variance using the Statistical Package for the Social Sciences (SPSS, 1997). Duncan multiple range test was used to separate the means.

Results

Proximate Composition of Experimental Diets and Ingredients

The dry matter (DM) contents of the experimental diets varied between 93 and 96% (Table 2). Crude protein (CP) content was higher for treatment 1and lower for treatment 4 which means that CP decreased as the level of rice milling waste increased in the diet. Crude fibre (CF) content increased from treatment 1 to treatment 4. Acid detergent fibre (ADF) was higher for treatment 4 and lower for treatment 1.

Crude protein (CP) was higher for wheat offal and lower for rice bran. Crude fibre (CF) level from rice milling waste is higher than that of the wheat offal. Ether extract (EE), ash and acid detergent fibre was higher for rice milling waste than for wheat offal.

Feed Intake and Live weight Changes

Results on feed intake and live weight changes are presented on Table 3. There were no significant differences in average daily gain between treatments 2 and 4, and between treatments 2 and 3. Average dry matter (DM) intake (g/day) was significantly higher ($P<0.05$) in treatment 3 and significantly lower in treatment 1. When expressed as percentage of body weight, feed intake was higher for treatment 1 and lower for treatments 2 and 4. DM intake as % of body weight follows the same pattern as feed intake (expressed as % of body weight).

Treatment 1 recorded highest value (35.23) on feed gain ratio and was significantly different ($P<0.05$) from treatment 3 (13.63).

Cost of Production

Cost of feed (N / kg) decreased from N17.35/kg for treatment 1 to N11.65/ kg for treatment 4 (Table 4), indicating a decrease in cost with increasing levels of rice milling waste in the diets. Total cost of feed consumed (N) showed that there were no significant differences ($P>0.05$) between treatments 1, 2 and 3 while treatment 4 (N1217.95) was significantly the lowest in cost of feed consumed.

Cost of feed/ kg live weight grain showed that there were no significant differences ($P>0.05$) between treatments 2, 3 and 4.It is however significantly higher in treatment 1.

Table 2
Proximate composition of the experimental diets and ingredients (%)

Parameter	**Treatments (inclusion levels of rice milling waste (%)**				**Diet ingredients**	
	1(0)	**2 (15)**	**3(30)**	**4(45)**	**Wheat offal**	**Rice milling waste**
Dry matter (DM)	95.60	94.50	93.40	92.80	96.54	90.12
Crude protein (CP)	16.43	16.35	16.32	16.29	18.35	11.93
Crude fibre (CF)	23.07	26.24	29.16	31.83	10.53	12.66
Ether extract (EE)	5.27	6.34	7.53	8.86	3.67	13.74
NFE	41.43	40.23	38.36	37.95	47.95	31.15
Ash	10.21	9.65	9.82	8.56	5.46	10.52
Acid detergent fibre (ADF)	29.99	34.11	37.91	41.38	13.69	16.46

Table 3
Feed intake and live weight gain per head of growing Uda sheep fed diets containing varying levels of rice milling waste

Parameter	Treatments* (inclusion levels of rice milling waste %)				
	1(0)	**2 (15)**	**3(30)**	**4(45)**	**± SE**
Average initial weight (kg)	19.50	19.63	19.73	19.63	0.7
Average final weight (kg)	23.19	26.44	28.81	26.00	3.2
Average weight gain (kg/wk)	3.75^{b}	6.93^{ab}	9.19^{a}	6.38^{ab}	0.6
Average weekly gain (g/day)	0.31 ^{b}	0.57^{ab}	0.77a	0.53^{ab}	0.11
Average daily gain (g/day)	44.64^{c}	82.58^{ab}	109.37 ^{a}	75.89^{ab}	16.21
Average feed intake (g/day)	1151.63 ^{b}	1177.13 ^{b}	1396.67 ^{a}	1244.58^{ab}	29.2
Overall feed intake (kg)	96.76 ^{b}	99.00^{ab}	117.32 ^{a}	104.54^{ab}	1.84
Average dry matter intake (g/day)	1101.19^{b}	1113.76^{b}	13.4.49 ^{a}	1154.97 ^{b}	10.70
Feed intake as% of body weight	4.97^{a}	4.45^{b}	4.85^{ab}	4.79 ^{b}	0.2
DM intake as% of body weight	4.75 ^{a}	4.21 ^{b}	4.53^{ab}	4.44 ^{b}	0.2
Feed gain ratio	35.23 ^{a}	17.24^{ab}	13.63^{b}	17.09^{ab}	4.40

*Means in the same row with different superscripts are significantly different (P<0.05)

Table 4
Cost of production of growing Uda sheep fed varying levels of rice milling waste

Parameter	Treatments (inclusion levels of rice milling waste %)				
	1(0)	**2(15)**	**3(30)**	**4(45)**	**SE**
Cost of feed (N/kg)	179.35	15.30	13.40	11.65	0.04
Overall feed intake (kg)	96.76^{b}	99.00^{ab}	117.32 ^{a}	104.54^{ab}	1.84
Total cost of feed consumed (N)	1678.74^{a}	1514.71^{a}	1572.09 ^{a}	1217.95^{b}	26.40
Cost of feed/kg live weight gain (N)	611.17^{a}	263.85^{b}	182.63^{b}	199.16^{b}	11.52

a, b, c Means in the same row with different superscripts are significantly different (P<0.05)

Discussion

Results on proximate composition showed that crude protein contents (16.29 – 16.43%) of the experimental diets were within the values of 15 – 18% recommended by ARC (1990) for growing sheep. Adu (1985) reported 15-18% CP levels when maize was replaced with brewer's dried grains in the diet of growing sheep. Ether extract (EE) and crude fibre (CF) increased with increasing levels of rice milling waste in the diet. However, EE, CF and NFE values obtained from the present study were comparable to the report of Adebowale and Taiwo (1996).

Results of this experiment indicate an increase in feed intake with increasing levels of rice milling waste even though treatment 4 had a lower feed intake compared to treatment 3 but not significantly different. The increased (P>0.05) feed intake with increasing levels of rice milling waste, could be due to the fact that roughages of low quality tend to be eaten more by the animals in order to satisfy their needs for energy and other nutrients (McDonald *et al.*, 1995). Variation in feed intake between treatments 3 and 4 could be as a result of individual differences among the experimental animals. One possible explanation for this is that the animals were obtained from different sources with possible differences in management systems. This could have led to individual animal differences as regards their adaptation to the feeding conditions, even though measures were taken to eliminate these differences at the beginning of the experiment. Payne (1990) and Lynch *et al.* (1992) had earlier reported that individual variation affected the rate of feed intake in sheep and other ruminants.

This experiment also indicated that the Average Daily Gain (ADG) obtained for animals on 30% (109.37g) rice milling waste diet was better than the ADG of 53g/day reported by Abil *et al.* (1992) when they replaced cotton seed cake and maize with wheat bran in the diet of sheep. Adu (1985) also reported an ADG of 65 g when he replaced maize with brewer's dried grains in the diet of growing sheep, which is less than the ADG obtained from animals on 45% rice milling waste diets (75.89g/day). AFRIS (2004) had earlier reported that ammoniated rice hulls could be included to a proportion of up to 40% of the total ration for sheep, without digestive or mastication problems. Maigandi *et al.* (2002) reported an ADG of between 68 and 93 g when they replaced cowpea husk with fore stomach digesta (FSD) in the diet of growing sheep.

The lower value ADG exhibited by animals on treatment 1 (0% rice milling waste diet) could be associated with the incidence of diarrhea, which has led to loss of weight by animals on the treatment. This might be due to the higher level of wheat offal (45%) fed to the animals on the treatment. This value (45% wheat offal) was above the 30% reported by Abil (1986) when he replaced maize and cotton seed cake with wheat offal in the diet of sheep.

Average daily gain (ADG) recorded for this experiment (44-109g) is comparable to what had been reported for conventional feed ingredients. For example, Adu and Brinckman (1981) reported ADG values of 78 – 183g when they fed fattened sheep with varying levels of guinea corn and groundnut cake with *Digitaria smutsii* hay as source of roughage.

Economics of incorporating rice milling waste on the performance of animals in this study indicated that cost of feed per kg live-weight gain was lowest (N182.63) at 30% inclusion level of rice milling waste, followed by 45% rice milling waste diet (N199.16) and then 15% rice milling waste diet (N263.17). The results of the present study indicated that once rice milling waste is included in the diet of growing sheep even at 15%, the cost of feed per kg live weight gain will be significantly reduced. It is evident, therefore, that the use of unconventional feeds can reduce the cost of livestock production. Similar observations were made by Maigandi *et al.* (2002) when they used fore-stomach digesta in the diet of growing sheep.

Conclusion and Recommendations

This study indicated that rice milling waste could be incorporated into the diet of growing sheep up to 45% level without significantly affecting performance. However, for best economic returns the inclusion rate should not be beyond 30 %. This assertion may, however, vary with time and place due to spatial and temporal variations in prices of feed ingredients. Finally, it is recommended that more trials should be carried out with different breeds of sheep in order to ascertain the true feeding value of rice milling waste. Results of such experiments could be used to formulate cheaper feed packages to be used as supplement for sheep and other ruminants especially during dry seasons.

References

Abil, J.U. (1986). *Nutritive value of wheat offal in the feeding of sheep*. M. Sc. Thesis, Ahmadu Bello University, Zaria.

Abil, J.U., P.A. Iji, N.N. Umunna and N.I. Dim, (1992). The replacement value of wheat bran or cotton seed cake and maize in he diet of sheep. *Bull. Anim. Hlth. Prod. Afr.*, **41**: 65-69.

Abubakar, A. (2003). *Influence of yeast supplementation on the performance of broiler and layer chicken fed diets with high levels of rice bran*. Unpublished PhD Research Proposal, Department of Animal Science Usmanu Danfodiyo University, Sokoto, Nigeria.

Adebowale, E.A. and A.A. Taiwo (1996). Utilization of Crop Resources and agro-industrial by-products as complete diets for West African Dwarf sheep and goats. *Nig. J. Anim. Prod*., **23**(1): 153-160.

Adu, I.F. and W.L. Brinckman (1981). Feedlot performance and carcass characteristics of sheep fed varying concentrate levels. *J. Anim. Prod. Res*. **1**(1): 1-12.

Adu, I.F. (1985). Utilization of graded levels of brewer's dried grains by growing finishing sheep. *J. Anim. Prod. Res*., **1**(1): 1-12.

AFRIS (2004). Animal Feed Resources Information System. *http/www.fao.org/agap/defacult/htm*.

AOAC (1990). *Association of Official Analytical Chemists. Official Methods of Analysis (15th edition).* Vol. I, Arlington, Virginia, USA.

ARC (1990). *The nutrient requirement for ruminant livestock. Technical review by agricultural research council working party*. CAB international, Wallington, Oxon.

Devendra, C. (1988). Sheep and Goat production in Guyana. *Zeit. Tier. zunch* **92**: 305-317.

Lufadeju, E.A. and S.A.S. Olorunju (1986). The ruminal degradation of some agro-industrial by-products. *Nig. J. Anim. Prod.*, **6**(2): 161-170.

Lynch, J.J., G.N. Hinch and D.B. Adams (1992). *The Behaviours of Sheep, Biological principles and implication for production*. C.A.B. International, Wallington Oxon.

Maigandi, S.A., H.M. Tukur and A.I. Daneji (2002). Fore-stomach digesta in the diet of growing sheep 1. Performance and economics of production. *Sokoto Journal of Veterinary Sciences*, **4**(2): 16-21.

McDonald, P.R.A., Edwards and J.F.D. Greenhalgh (1988). *Animal Nutrition (4th edition)*. Longman Group Limited, London. 212 pp.

McDonald, P.R.A., Edwards, J.F.D., Greenhalgh and C. A. Morgan (1995). Animal Nutrition (5th edition). Longman Group Limited, London.

Njewe, R.M. and B. Kona (1994). Comparative evaluation of stylo (*Stylosathes guianensis*) hay and concentrate as protein supplement for West African Dwarf sheep fed basal diet of elephants grass (*Pennisetum purpureum*) In: *Small Ruminant Research and Development in Africa. Proceeding of 3rd*

Biennial Conference of the African Small Ruminant Research Network, UICC, Kampala, Uganda, 5th – 9th December.

Nuru, S. (1982). Problems and Prospects of the Nigerian Beef Industry. In: *Osinowo, O. A., Ikhatua, U. J. and Ehoche, W. O. (eds). Beef Production in Nigeria Proceeding of the National Conference on Beef Production, July 27 – 30, Kaduna, Nigeria*.

Payne, W.J.A. (1990). *An Introduction to Animal Husbandry in the Tropics (4th edition).* Longman Singapore Publishers.

Ranjhan, S.K. and G. Krishna (1980). *Laboratory Manual for Nutrition Research*. Vikas Publishing House PVT, New Delhi, India.

SEPP (1996). *Sokoto Environmental Protection Programme, Meteorological Data (Unpublished).*

Smith, O.B. (1988). Studies on the Feeding Value of Agro-Industrial By-products. Effect of forage supplementation on the utilization of cocoa-pod based diets by ruminants. *J. Anim. Res*., **8**(1): 1-14.

SPSS (1997). *Statistical Package for the Social Sciences.* Release 10.0 SPSS Inc. 1997.

Steel, R.G.D. and J.H. Torrie, (1980). *Principles and Procedures of Statistics*. McGraw Hill Book co. Inc. New York.