

Cost benefit analysis of level of *Ziziphus (Ziziphus mauritiana)* leaf meal inclusion in the diet of growing rabbits

S.B. Abdu, M.R. Hassan, H.Y. Adamu, S.M. Yashim, M. Abdulrashid, S. Duru and G.E. Jokthan

Department of Animal Science Ahmadu Bello University, Zaria

Corresponding author: abdusb@gmail.com**Abstract**

Thirty (30) growing rabbits of mixed breeds and sexes with an average initial weight of 526.92 ± 0.25 g were used for this study to determine the effect of level of inclusion of *Ziziphus* leaf meal (ZLM) in concentrate diet on the performance of growing rabbits. The experiment was in a completely randomized design involving five treatments, which represented five diets with 0, 10, 20, 30 and 40% levels of ZLM inclusion. Significant differences ($p < 0.05$) were observed in weight gains, feed intake and feed:gain ratios. Treatment 2 had the highest weight gain (though not significantly different ($p > 0.05$) from treatment 1 and the best feed /gain values.

The cost benefit analysis shows a 40.51 % reduction in the cost of feed, following a 10 % inclusion of ZLM in the diet (T2) over the control (T1), while 46.35 and 47.94 % reduction were observed following 20 and 30 % ZLM inclusion (T3 and T4) respectively. In term of apparent profit made, T1 recorded the highest profit (₦ 35.29) over all other treatments, which was followed by T2 (₦ 30.49), T3 (₦ 15.11) and T4 recorded the least (₦ 12.99). Inclusion of RHSM in the diet of rabbits resulted in reduction in the cost of feed and feed cost efficiency. From the results obtained it was concluded that dried ZLM could be incorporated up to 30% in the diets of growing rabbits without any adverse effect on their performance.

Keywords: Cost benefit, growing rabbits, performance, tannins, *Ziziphus* leaf meal.

Introduction

It has been reported that Nigerians are not meeting the daily 75g of protein, of which 34g should be from an animal source required by the WHO (Akintola, 1999). The underlying factors responsible for this include high cost of regular sources of animal protein caused by demand which far outstrips supply (Oyenuga, 1982). This problem is further compounded by high cost of feed resources, which accounts for about 70-80 % of production cost (Ogundipe, 1987).

To solve this problem, attention is being focused on short cycle animals such as the rabbits, grass cutters and other micro livestock. These animals have been described as highly prolific animals with a short gestation period and capable of attaining maturity within a very short time

(FAO, 1981; Adejinmi *et al.*, 2007). Also, there is the need to adopt an improved strategy that will involve feeding rabbits with agro industrial by – products and the use of inexpensive, locally available raw materials as noted by M'cenes *et al.* (1989). Browse plants have been recognized as having the potential to serve as good feed resources, particularly in the dry season because of their year round availability. Simbaya (2002) reported that the crude protein content of fodder from shrubs and trees range from 14 to 25% and that supplementation of up to 35% was possible. *Ziziphus mauritiana* (Magarya in Hausa) is a browse plant traditionally used in feeding livestock in arid Nigeria. Morton (1987) reported that the leaves are readily eaten by animals and contain 12.5-16.9% CP, 13.9-17.1% CF, 11.5-2, 7% EE, 10.2-11.7% ash and 55.3-56.7%NFE.

However, the presence of anti nutritional factors limits the efficiency of utilization of such foliage in livestock nutrition. At high concentrations there is reduction of animal performance (Hove *et al.* 2001). *Ziziphus mauritiana* has been shown to contain tannin (Abdu *et al.*, 2007). There is therefore, the need to evaluate at what level of inclusion performance will not be adversely affected as it concerns rabbits production.

Material and methods

Location

The study was conducted at the rabbitry unit of the Department of Animal Science, Ahmadu Bello University, Samaru Zaria in the Northern Guinea Savanna on latitude 11° 12' N, longitude 7° 33'E, altitude 610 m. Annual rainfall is 1100-1200 mm while mean temperature is about 24.4°C (14.5-39.3°C) with the lowest temperature occurring during the early dry season (November-January) while the higher temperatures are experienced during the late dry season (February-April).

Experimental animals and their management

Thirty (30) growing rabbits of mixed breed and sexes with average initial weight of 526.92 ± 0.25g obtained from Samaru were used for this study. Prior to the commencement of the experiments, the rabbits were prophylactically treated against internal and external parasites by subcutaneous injection of Ivomec® (0.2ml/rabbit), and a broad-spectrum antibiotic (Oxytetracycline L.A®) was also given subcutaneously at the rate of 0.2ml/rabbit. After balancing for weight, the rabbits were randomly grouped into five (5) dietary treatments with six (6) rabbits per treatment in a completely randomized design.

The rabbits were housed in a three-tier cage

unit, with each cage measuring 40 × 40 × 60 cm³. Each cage was equipped with plastic drinkers and aluminum feeders. The cages were housed in a room with concrete floor and windows for proper ventilation. Feed and water was supplied *ad libitum*. Proper sanitary condition was maintained throughout the experimental period. The experiment lasted for 8 weeks.

Experimental diet

The *ziziphus* (*ziziphus mauritiana*) leaf meal used for this study was harvested from plants in the outskirts of Samaru. The pruned branches were sun dried, milled to appropriate size and bagged before incorporation into the experimental diets. The percent composition of the experimental diet is presented in Table 1. Five isonitrogenous diets with 18% CP were formulated to contain ZLM at 0, 10, 20, 30 and 40 % levels of inclusion to replace Soya bean meal. Other ingredients in the diets are maize bran, wheat offal, salt, bone meal and vitamin and mineral premix.

Data collection

The rabbits were fed twice a day at 7:00AM and 4:00PM. Spilled and contaminated feed was recovered, air dried, weighed and subtracted from the amount of feed offered. Feed intake was then determined by difference between feed offered and weigh back. Weight gain was measured weekly.

Economic analysis

The feed cost was computed based on the current market price of feedstuff at the time of the experiment. Feed cost per Kg live weight gain, cost savings, value of gain and income over feed cost were calculated based on current cost of live rabbit.

Proximate analysis

The dry matter content of feed and ZLM were determined by drying the samples at 60°C for 48 hours, crude fiber (CF) content – by means of Foss Tecator Analyzer, ether extract content – by Soxtec System 1040

Table1. Percent composition of ingredients in the experimental diet.

Ingredients	Percent level of ZLM inclusion				
	0	10	20	30	40
Maize offal	64.11	62.25	53.73	45.21	36.71
Soya bean cake	13.32	17.75	12.01	11.27	10.52
ZLM	0	10	20	30	40
BDG	13.32	17.75	12.01	11.27	10.52
Bone meal	1.5	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5	0.5
Premix	0.25	0.25	0.25	0.25	0.25
Rice bran	7	-	-	-	-
Total	100	100	100	100	100

and ash content – by combustion at 550°C in Muffle furnace. Kjeldahl nitrogen analyses were performed in duplicate on dried feed samples and CP calculated as (N x 6.25) according to (AOAC 2000) procedure.

Statistical analysis

The data obtained from the studies were subjected to analysis of variance (ANOVA) procedure of SAS (2001) in a completely randomized design. Duncan multiple range test (DMRT) (Duncan, 1955) was used to compare the means.

Results and discussion

The result of the proximate analysis of the experimental diets is presented in table 2. The CP content of ZLM (17.1) was comparable with the 16.9% reported by Morton (1987) and Abdu et al. (2007) and was within the range of 14- 25% reported by Simbaya (2002) for trees and shrub fodder. The CF content was lower than the 13.5-17.1% reported by Morton (1987), this may be attributed to stage growth, ratio of stem

to leaves. Similarly the ash content was lower than the 10.2 -11.7% range reported by Morton (1987) but was however, higher than 6.1% given by Mecha and Adegbola (1980) for most West African browse trees and shrubs.

The results of the performance studies are presented in Table 3. It showed significant differences (p<0.05) with respect to weight gain, average daily feed intake and feed: gain ratio across the dietary treatments. Average daily feed intake showed an increasing trend with increase in the level of ZLM in the diet. Diets 1, 2, and 3 recorded values (66.38, 68.37 and 65.46g respectively) that were statistically similar but were significantly (p<0.05) different from those of diets 4 and 5 (72.68 and 72.01 respectively), which were similar statistically. This trend was as a result of decreasing energy level that accompanied the increasing ZLM in the diet and is in consonance with the report of Stanford (1986) that growing rabbits regulate their

Table 2. Proximate composition of experimental feed

Parameters	Percent level of ZLM inclusion					ZLM
	0	10	20	30	40	
Dry matter	93.62	95.26	93.49	92.58	92.94	94.44
Crude protein	18.47	18.81	19.21	18.09	18.61	17.46
Crude fiber	5.56	7.08	6.48	8.38	8.62	7.89
Ether extract	5.28	4.98	5.06	5.00	5.31	4.99
Ash	8.00	8.23	11.38	10.64	12.24	8.30
Nitrogen free extract	62.68	60.90	57.87	57.89	55.22	61.36

Table3. Performance of Rabbits fed graded level of ZLM

Parameters	Percent level of ZLM inclusion					SEM
	0	10	20	30	40	
Initial Weight (g)	527.17	526.67	526.67	527.00	526.67	19.47 ^{NS}
Final weight (g)	1257.70 ^{ab}	1311.80 ^a	1266.80 ^{ab}	1208.20 ^b	1190.00 ^c	33.64
AWG (g)	730.50 ^b	785.17 ^a	739.83 ^b	681.50 ^c	663.33 ^c	25.81
ADWG (g)	14.91 ^b	16.03 ^a	15.10 ^{ab}	13.91 ^c	13.54 ^c	0.53
ADFI (g)	66.38 ^a	68.37 ^a	65.46 ^{ab}	62.68 ^b	62.01 ^b	1.84
Feed to gain ratio	4.45 ^b	4.26 ^b	4.33 ^b	4.50 ^b	4.57 ^a	0.13
Mortality	0	0	0	0	0	-

^{a,b,c} means with different superscript within the same raw differ significantly (p<0.05)

SEM=standard error of means AWG=Average weight gain,

ADWG=Average daily weight gain, ADFI=Average daily feed intake

feed intake according to energy content.

Feed/gain value of treatment 2 was the best, though not significantly different from that of diet 1 but was different from those of diets 3, 4 and 5 which followed in order. The mean was comparable with the report of Raharjo *et al.* (1986) who had 4.91 feeding 55g concentrate/sesbania leaf meal and was slightly better than 5.5, 5.8 and 6.7 observed by Abdulmalik *et al.* (1997) when he fed growing rabbits with 37.5g concentrates plus Mucuna, lablab and ground nut haulm respectively. The best feed/gain ratio observed in diet 2 may be attributed to a better combination of nutrients in the diet. The significantly poor

values from 3 to 5 could be attributed to the report of Raimondi *et al.* (1973) that better feed/gain values are obtained with increasing energy which was the case from diet 5 to 2. Diet 2 showed the highest weight gain (785.17), which was comparable with that of diet 4 but significantly (p<0.05) better than the control diet (730.5). This agreed with the report of Dematerova *et al.* (1991) that combination of forage/concentrate was better than that of forage or concentrate alone. However, there was a significant (p<0.05) decrease in weight as level of ZLM increased. This trend was similar with the report of Onimisi *et al.* (2007) who reported a linear decrease

Table 4. Cost benefit analysis of Ziziphus leaf meal inclusion in the diet of rabbit

Parameters	Dietary treatments (levels of Ziziphus meal inclusion)				
	0	10	20	30	40
Cost/kg diet(₦)	41.08	39.02	36.19	33.35	30.52
AV DFI (g)	66.38	68.37	65.46	62.68	62.01
TFI(g)	3717.28	3828.72	3665.76	3510.08	3472.56
Cost of DFI(₦/d)	0.27	0.26	0.23	0.20	0.18
ADWG(g/d)	14.91	16.03	15.1	13.91	13.54
Feed Cost Efficiency(₦/g)	0.018	0.016	0.015	0.015	0.013
TWG (g)	834.96	897.68	845.6	778.96	758.24
Income accruable (₦)	54.27	58.34	54.96	50.63	49.28
Cost of TFC (₦)	15.27	14.93	13.26	11.70	10.59
Apparent profit (₦)	39.00	43.40	41.69	38.92	38.68

AV DFI = average daily feed intake ADWG = average daily weight gain DFI = daily feed intake TWG = Total weight gain TFI = total feed intake TFC = total feed consumed DFI = daily feed intake TWG = total weight gain

in weight gain with increasing levels of *Moringa oleifera* leaf meal. The average daily weight gain (14.7) was comparable with 14.7g/day and 12.7g/day reported by Raharjo *et al.* (1986) when 55gconcentrate/leucaena and sesbania leaf meals respectively were fed to rabbits.

Conclusion and recommendation

The experimental results showed that diet 2 (10%) ZLM inclusion gave the best result compared to the other treatments. It was therefore concluded that ZLM could be included up to 30% in the diet of growing rabbits without compromising performance. To use dried ZLM at higher levels of inclusion, proper attention should be given to the energy level, which could have being a limiting factor as ZLM level increases in the diet.

Acknowledgement

The researchers would like to acknowledge the contributions of Mr. Ibrahim Kwano and Miss Ojo of the Biochemical laboratory and Mr. Ameh of the Teaching and Research farm of the Department of Animal Science.

References

- Abdu, S.B., Ehoche, O.W., Adamu, A.M., Yashim, S.M. and Jokthan, G.E. 2007. Evaluation of processing methods on biochemical composition of *Ziziphus* (*Ziziphus mauritiana*) leaf meal. *Trop. J. Anim. Sci.* 10(1-2): 441-443
- Abdulmalik, M. E., Erakpotobor, G. I., Abeke, F. O., Adeyinka I. A., Bawa, G. S. 1997. Determination of optimum forage concentrate combination for weaner rabbits under intensive fattening. Ann. of conference of Nigerian society for animal production (NSAP), held from Abubakar Tafawa Balewa University, Bauchi.
- Adegbola, T. A. and Mecha, I. 1980. Chemical composition of some southern Nigerian forage eaten by goats. IN: Le Houerou, H. N. (ed). *Browse in Africa, the current state of knowledge*. ILCA, Addis Ababa, 19(1) 77-80.
- Adejinmi, O. O. Hamzat, K .A. and Fapolunda, J.B. 2007. Performance and nutritional digestibility of rabbits fed fermented and unfermented cocoa pod husk. *Nig. J of animal production* .34:(1and2) 63-64.
- Akintola, E. O., Kehinde A. S., Abu, O. A., and Tewe O. O. 1999. Performance and economy of growing pigs fed whole cassava plant basal diet in the tropics. *Tropical animal prod. investigation* 2, 181-186.
- FAO 1981. Expert consultation on rural poultry and rabbit production. FAO secretariat, Rome.
- Duncan, D. B. 1955. Multiple range and multiple F-test. *Biometric* 11:11-42.
- Hove, L., Topps J. H., Sibanda S. and Ndlovu L. R. 2001. Nutrient intake and utilization by goats fed dried leaves of the shrub legumes *Acacia angustissima*, *Calliandra calothyrsus*, and *Leucaena leucocephala* as supplements to native pasture hay. *Animal Feed Sci. and Technology*. 91: 95-106.
- M'cenes, Gppert t., Szabo I., NAGnogua, L. 1989. Utilization of sun flower husk meal in feeding Meat type rabbit. *Nutr. Abstract and review*. 53(1): 60
- Morton, J. F. 1(987). Indian jujube In: Morton, J. F. (Ed). *Fruits of warm climates*, Miami, Florida. Pp 272-275.
- Ogundipe, S. O. 1987. Non-conventional poultry feedstuffs from research to practice. Paper presented at poultry farmers workshop, EARLS ABU, Zaria.

- Onimisi P. A., Omage, J.J. and Maiguizo, K. 2007.** Evaluation of Moringa oleifera leaf meal as protein source in rabbit diet IN: Proceeding of 32nd annual conference of Nigerian Society for animal prod. Calabar. March 18th – 21st 2007.
- Oyenuga, V.O. 1982.** Future of the beef industry in Nigeria. In: proceedings of the national conference on beef prod., Kaduna July, 1992, NAERLS pp58-59
- Raharjo, Y. C., Cheeke, P. R., Tangendijaja, B. and Patton, N. M. 1988.** Evaluation of tropical forages and by products as feed for rabbit prod.2 In: Rice bran, nutritive value, utilization & effect of supplementation. *J. of Applied Rabbit Resarch.* 11: 257-263.
- Raimondi et al. 1973.** Cited by Onimisi, P. A. (1997). Effect of graded substitution of poultry litter in whole concentrate diets on growing rabbits. B. Agric. Project, Dept. of Animal Sci. ABU, Zaria.
- SAS (2001).** Procedures Guide: version 9.1. Statistical Analysis Systems Institute, Cary, NC.
- Simbaya, J. 2002.** Potential of tree fodder/shrubs legumes as feed resources for dry season supplementation of smallholder ruminant animals. National institute for sci. and industrial research. Livestock and pest research centre, Chilanga, Zambia. P 69-70.
- Stanford, J. C. 1986.** *The domestic rabbit, 4th edition.* Collins, London. Pp 62.

Received: 20th March, 2010

Accepted: 5th December, 2012