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(Research Article)

Performances and economics of weaned rabbits fed varying inclusion levels of *Bambusa arundinancea* leaf meal (BLM) as replacement for wheat offal

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Abstract

Twelve (12) weaned rabbits of mixed breeds were used for a 49days feeding trial to evaluate their performance on a diet containing graded levels of Bamboo leaf meal (BLM) and wheat offal (W/O). Animals in all the treatment groups were fed a partial or total replacement of BLM and W/O at the ratio of 0:100 (T_A), 50:50 (T_B) and 100:0 (T_c) respectively. All the animals were also served water ad libitum. All the rabbits were randomly assigned to three dietary treatments of 4 rabbits per treatment and 2 per replicates in a completely randomized experimental designs, data were analyzed using a one way analysis of variance and treatment means separated using least significant difference (LSD). Proximate analyses of the tested feedstuffs were carried out at the end of the trial. Performance parameters showed that average feed intake (18,662.89, 19,332.86, 19,220.88, T_A T_B and T_C respectively) and average weight gain (3,050g, 3,230g, 3.460g for T_A, T_B and T_C respectively) were not significantly (P>0.05) different. However T_C had the best numerical value among others while the Control (T_A) recorded the least. Significant effect (P<0.05) was observed in Feed Conversion Efficiency (FCE) between control group and other groups. Generally, T_C recorded the best performance in term of growth and feed utilization. Based on the result of this work, it was concluded that Bamboo leaf meal can be used for rabbit feeding partially or wholly with wheat offal during the long dry season.

Keywords: Performance; Weaned rabbit; Bamboo leaf meal; Replacement; Wheat offal

1 Introduction

Inadequate supply of proteins to the citizen of the nation from conventional livestock such as cattle, goat, sheep, pig and poultry has prompted the need to search for alternative protein sources that are cheap, readily available and also, have minimal competition with man (Akinmutimi, 2007). As a contingent plan, the search for more economical source of animal proteins makes rabbit production attractive (Egbo *et al.,* 2001). Rabbits (*Oryctolagus cuniculus*) has therefore become a viable option, not only because of their prolificacy, but also because they mature early, possess ability to grow fast, have high genetic selection potential, are known to exhibit high feed conversion efficiency and because they economically utilize space (Owen *et al.,* 2008; Yusuf *et al.,* 2009; Yahaya and Wekhe, 2014).

The problem for most rabbit producers however, is the high cost of commercial pellets which may constitute as much as 70% of the total cost of production. This has necessitated the need to seek for alternative feed sources to forages, since the greater availability of forages and ability of rabbits to convert forage into meat for human consumption is evident. Rabbit being a monogastric herbivores can cope with plant materials, such as grasses, legumes and can also thrive on forage diet, although potential weight gains may not be attained because of the poor nutritive value of some tropical forage (Aregboola *et al.,* 1984).

Despite the ability of the rabbits to thrive successfully on forages, majority of the forages are usually in great abundance during the wet season. Unavailability of some conventional forages such as *Tridax procumbens, Euphorbia hita* and

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Aspilia africana during the dry season had become a great challenge for most producers making them to solely depend on concentrates during this scarcity period and hence increasing the cost of producing this highly nutritious animal. Bamboo is a perennial plant, readily available throughout the year and has been reportedly used in feeding livestock such as cattle, horse and sheep (Makinde *et al.,* 2015).

Bamboos are members of the Graminae (Poaceae) family, such as are corn, sugar cane and other grasses. Bamboos differ from the other members of the grass family by the presence of branches at each node. A bamboo culm consists of an internode (which is hollow for most bamboo) and a node, which is solid and provides structural integrity for the plant. At the node are one or more buds (depending on the species) which produce side branches. However, Bamboo (*B. arundinaceae*) leaves generally contain some bioactive compound and nutritional properties like flavonoids and are already used in folk medicine (Nakajima, *et al*. 2003, Zhang *et al*, 2007) due to their anti-inflammatory and anti-ulcer properties (Rathmod, 2011). The chemical composition of the Bamboo leaves from different species strengthens the possibility of their utilization as potential forage in rabbit diet.

Leaves of bamboo were reported to possess antioxidant potentials due to the presence of biologically active components groups (Nakajima *et al.,* 2003; Zhang *et al.,* 2005; Ajayi, 2013) and also rich in proteins like gluteline, lysine, methionine, betain, cholin, proteolytic enzymes like nuclease and urease (Egbo *et al.,* 2001). The high crude protein (18.39-19.39%) and fibre content (26.78-33.19%) range of some bamboo leaves species makes it suitable for livestock feed (Egbo *et al.,* 2001) and also compare well with other browse plants as forages used in livestock feeding. The objective of this study is therefore, to evaluate the performances and economy of production of rabbit fed with *Bambusa arundinancea* in partial or total replacement of wheat offal.

2 Material and methods

2.1 Experimental site

The study was carried out at the rabbitry unit of the Department of Agricultural Education, Oyo State College of Education Lanlate, Oyo State, Nigeria. The farm Station is located in the south-western part of Nigeria. The college falls within latitude 7.54972, longitude 3.45 with coordinate 7⁰32′58″ North, Latitude 3⁰27′0″ East.

2.2 Experimental Animals, diets and management

A total of twelve (12) grower rabbits of mixed breed were used for a 49 day feeding trial to evaluate their performances and economics of diet containing graded levels of Bamboo leaf meal (BLM) in partial or total replacement of wheat offal (W/O). The animals used were of male sex, the animals were kept in cages. Cages used for the rabbit were repaired, netting was made to block the loophole, replacement of roofing sheet that has rusted and the hutches were disinfected prior to the arrival of the rabbits. On arrivals of the rabbits, water and feed were given to the rabbits ad-libitum, anti-stress (multi-vitamin) was administered in water to reduce the stress during transportation. Rabbit were also dewormed with Piperazine after treated with oxytetracycline (20%) long acting injection at the thigh muscle 1ml/10kg body weight. They were allowed to acclimatize for a period of one week before commencement of the experiment. At the commencement of the experiment, the animals were randomly divided into three dietary treatments of four animals per treatment and two per replicate.

2.3 Sources of feed ingredients and experimental animals

The mixed breed between chinchilla and New Zealand rabbits were purchased from peasant rabbit farm around Eruwa, Oyo state, Nigeria. *Bambusa arundinacea* leaf was obtained from the available *Bambusa arundinacea* plots in Lanlate and Eruwa. The harvested *Bambusa arundinacea* leaves were air dried in shade under a shed until they were crispy to touch, while retaining their greenish colouration. The leaves were then milled using a hammer mill of sieve size 3 mm, to obtain a sizeable product which could be compounded in diet, and this is referred to as *Bambusa arundinacea* leaf meal, then was stored in sacs until needed.

2.4 Experimental diet

Three experimental diets were formulated. Diet 1 (T_1), which was designated to serve as the control diet with no *Bambusa arundinacea* leaf meal contained 0% BLM 100% W/O, Diet 2 as T_2 contained *Bambusa arundinacea* leaf meal at the rate of 50% BLM, 50% Wheat Offal, while T_3 diet contain 100% inclusion of BLM and 0% W/O. The experimental diets were offered in separate ceramic feeders in the morning (08:00h), while the leftover feed was determined after 24hrs. The daily supply was about 5% body weight of the rabbit, while clean fresh water was supplied throughout the period.

2.5 Experimental design and duration of experiment

The three treatment groups were assigned to three experimental diets in a completely randomized design (CRD). Each treatment was replicated twice and there were two rabbits per replicate. Each rabbit was fed for a period of seven weeks which started on 14 November, 2022 and lasted for seven (7) weeks after one week of adjustment period.

2.6 Statistical analysis

Analysis of variance (ANOVA) for Completely Randomized Design (CRD) was carried out using GenStat (Release 4.24) statistical package (Genstat, 2005). Differences between means were separated by the Least Significant Difference (LSD).

3 Results and discussion

Differences in the proximate composition of Bambusa leaf meal and wheat offal were presented in table 1. The table revealed that values were very marginal apart from NFE with a minor difference in favour of BLM and Wheat offal respectively. The crude protein of Bambusa leaves in this study was high (20.00%CP) compared to wheat offal, even higher than any other species of bamboo leaves, this compares with Akinmoladun *et al.,* (2018), who reported *B. vittata* 18.75%, *B. vulgaris* 18.39%, *B. venticosa* 19.02% and *B. abussinica* 19.39%. The higher crude protein content in this study for the Bambusa leave than wheat offal can be attested by corresponding increase in average weight of rabbit from Treatment A (0% inclusion) progressively to Treatment C (100% of inclusion) of Bambusa leaf meal. The Crude protein values for the experimental diets were increasing, slightly along with inclusion level increment of the BLM. The recorded average body weight gain values in this research were higher than those reported by *Idowu et al*., (2013), though not significantly higher (P>0.05). The difference in weight could be partly due to better protein quality, possibly arising from a higher supply of methionine and lysine in *Bambusa arundinacea*. Normally, the higher weight gain of animals in Treatment C (100% Bamboo inclusion) resulted from the increased feed intake when compared with control (0% inclusion) experiment.

The high crude fibre concentration (29.00%CF) of bambusa leaf suggests that animals will prefer them when compared with alternatives with lower crude fibre level. This supports previous findings, like Fairelly (1984) who concluded that bamboo leaves can impart superior physical tone and agility to livestock, since fibre speeds up the process of digestion by improving peristalsis of the gastrointestinal tract (GIT). Furthermore, fibre is known to promote caecal fermentation in rabbit, hence improving digestive health (Xiccato *et al.,* 2011). The increased dietary fibre has also been reported to modify concentration of caecal VFA, thereby, preventing colon cancer and instrumental in preventing infant mortality in young rabbits (Trocino *et al.,* 2013), this is also in tandem with the findings in this study which revealed progressive increase in weight of rabbits corresponding to increase in Bamboo leaves fraction inclusion in the diets.

The bamboo leave used in this study contain little amount of crude fat when compared with its peer, this could likely be the reason for a prolong shelf life in term of storage since it is resistant to mouldiness. The ash content (20.00%Ash) is higher when compare to wheat offal, this reveal the mineral content bamboo leaf possesses. The result obtained in this work agrees with findings of Idowu *et al*., (2021) which admitted that Bamboo leave possess high ca, mg, k and moderate p content, the implication of this, is that the higher the inclusion rate of Bambusa leave the better the bone formation and development in rabbits.

Table 1 Chemical Composition of *Bambusa arundinancea* Leaf Meal (BLM) and Wheat Offal (WO) (%)

Parameters	ASH	CF	EE	CP	DM	NFE
BLM	20.00	29.00	2.71	21.85	76.00	34.54
Wheat Offal	6.40	10.00	4.50	17.60	95.56	30.20

EE = Ether Extract, CF = Crude fibre, CP = Crude Protein, DM = Dry matter, NFE = Nitrogen Free Extract

Table 2 Average feed intake/g/rabbit/week

	TREATMENT A		TREATMENT B		TREATMENT C	
WEEK	R1	R2	R1	R2	R1	R2
1.	547.88	847.01	848.94	848.92	848.26	848.62
2	1346.00	1346.00	1347.00	1348.00	1347.00	1347.00
3	1395.00	1397.00	1398.00	1398.00	1398.00	1398.00
4	1397.00	1398.00	1398.00	1398.00	1399.00	1398.00
5	1398.00	1399.00	1399.00	1398.00	1398.00	1398.00
6	1399.00	1399.00	1398.00	1398.00	1399.00	1398.00
7	1697.00	1697.00	1698.00	1697.00	1698.00	1946.00
Total	9,179.88	9,483.01	9,486.96	9,485.92	9,487.26	9,733.62
Sum Total	18662.89		19,332.86		19,220.88	
Mean	2,666.13		2,761.84		2,745.84	
G/Day	380.88		394.55		392.26	

Table 3 Average Body Weight Gain

	TREATMENT A		TREATMENT B		TREATMENT C	
WEEK	R1	R2	R1	R2	R1	R2
1.	204.00	299.00	270.00	170.00	150.00	184.00
2.	92.00	70.00	580.00	190.00	250.00	176.00
3.	191.00	177.00	151.00	150.00	270.00	445.00
4.	153.00	176.00	152.00	98.00	167.00	497.00
5.	234.00	176.00	197.00	161.00	273.00	390.00
6.	141.00	676.00	711.00	95.00	37.00	92.00
7.	164.00	733.00	138.00	771.00	20.00	6.00
Total	1179.00	2310.00	2199.00	1635.00	1167.00	1790.00
Sum Total	3489.00		3834.00		2957.00	
Mean	498.43		547.71		422.43	
G/DAY	71.20		78.24		60.35	

Table 4 Feed Efficiency and Conversion ratio of Rabbits

PARAMETERS	TREATMENT A	TREATMENT B	TREATMENT C
Average feed consumed	2,661.3	2,761.84	2,745.84
Average weight gain	498.43	547.71	422.43
Feed conversion ratio (FCR/FCE)	5.33	5.04	6.50

$$FEED\ CONVERSION\ EFFICIENCY\ (FCE) = \frac{Average\ feed\ consumed}{Average\ weight\ gain}(g)$$

The general performance of rabbits fed with experimental diet was presented in table 5 below. From the table, initial weight of rabbits were relatively closer but not same. Average weight gain is the difference between initial weight and final/total weight of the rabbits. In all the experimental rabbit, average weight gain were not significantly different (p>0.05), however, the highest weight gain (3,460g) was recorded for rabbits in treatment C (100% BLM), followed by rabbit with 50% inclusion while the lowest among the group is the control experiment, the reason could be trace to increase dietary fibre and crude protein found in treatment B and treatment C respectively. This results is in accord with findings of Fairelly, 1984 and Cheeke et al., (1986) that dietary fibre promote caeca fermentation, intenstinal motility and nutrient digestibility also increased crude proten support growth & development in growing rabbits.

There is significant differences (p<0.05) in weight gain and feed intake of control group (0% Bambusa and 100% w/o) and other groups, meanwhile, T_c (100% Bambusa 0% wheat offal) had better results numerically in all parameter measured. The feed conversion efficiency follows the same trend, however the values obtained in Treatment B and Treatment C could be attributed to the lignin content of the diets and native of feeding trial.

Economically, bamboo leaf inclusion led to increased income in accordance to the increment of the Bamboo leaf meal inclusion level from T_A (0% BLM) to T_C (100% BLM). This condition is expected, since a higher BLM diets contained less expensive wheat offal in terms of price of feedstuffs. Though the gross margin were not significantly different (P>0.05) among the treatments but the cost of diets in $Treatment_B$ and $Treatment_C$ reduced which resulted in the increased income rate from weaner rabbits that possess more carcass.

Table 5 Performance of rabbit fed varying inclusion levels of bambusa leaf

	Replacement levels of bambusa leaf		
	(100:0)	**(50:50)**	**(0:100)**
Parameters (G)	**Treatment A**	**Treatment B**	**Treatment C**
Initial weight of Rabbits	2,790^a	4,070^b	4,320^b
Average weight gain (g)	3,050^b	3,230^b	3,460^b
Total weight gain (g)	5,840^a	7,300^b	7,780^c
Average feed intake (g)/Week	18,662.89^c	19,332.86^c	19,220.88^c
Average feed intake (g)/day	380.88^a	394.55^a	392.26^a
Feed Conversion Ratio FCR (1-7) weeks	0.54^a	5.04^b	6.50^b
	Economic of production of rabbits		
Cost of feed/kg (₦)	300.00	150.00	100.00
Cost of feed/g (₦)	0.3	0.15	0.10
Daily feed intake rabbit (g)	380.88	394.55	392.26
Cost of intake (₦)	114.26	59.18	39.23
Total weight gain	5840	7300	7780
Revenue (₦)	9,000.00	10,600.00	12,000.00
Gross Margin	8,885.74	10,540.00	11,960.77

4 Conclusion

It can be concluded from this study that bamboo leaf meal can be utilized effectively in partial or total replacement with wheat offal in feeding trial. Given the perennial nature of Bamboo leaves, it could help in reducing the overdependence on conventional feedstuffs thereby reducing the cost of production especially during the dry season when herbaceous forages were not available or limited in supply. Furthermore, bamboo leaf can also help to reduce the cost of livestock production, vis a vis increased revenue and gross margin when included in the feed of livestock.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

The animal study protocol was approved by the Committee on the ethics of Animal Experiments of the College (protocol number 23/00123)

References

[1] Ajayi, K. R. (2013). Bambusa arundinacea (vanshlochan): An overview. Int. J. of Res in Pharmacology and Pharmacotherapeutics, 2(1): 248- 255.

[2] Akinmoladun, O. F., Adejoro, V. and Jimoh, A. (2018). Performance and carcass characteristics of Rabbits fed Diets with Total or Partial Replacement of Tridax procumbens by Bamboo. Journal of Experimental Agriculture International, 217 (1), 1-10.

[3] Akinmutimi, A. H. (2007). Effects of Quantitative Replacement of Soya Bean meal with Raw Sword Bean (Canavaliagladiata) Meal in Grower Rabbit Diets. J. Anim. Vet. Adv., 5(8): 695-698.

[4] Aregbola, S. F., Church, J. P., Judd, J. T., Young, C. W., Kebay, J. L. and Kin, W. W. (1984). Relationships among dietary constituents and specific serum clinical components of subjects eating self- selected diet. American Journal of Clinical Nutrition, 40: 1338-1344.

[5] Cheeke, P. R., Grobner, M. A. and Patton, N. M. (1986): Fibre digestion and utilization in rabbits. J. appl. Rabbit Res. 9 (1), 25-30.

[6] Egbo, M. L., Doma, U. D. and Lacdacks, A. B. (2001). Characteristics of small scale Rabbit production and management in Bauchi (NSAP). Ahmadu Bello University, Zaria, pages 160 – 162

[7] Farrelly, D. (1984). The book of bamboo. Sierra club Books, San Francisco, California

[8] Idowu, O. M. O., Oso, A. O., Adeyemi, O. A., Osho, S. O., Idowu, O. P. A. and Ijaya, A. T. (2013): Growth response and apparent nutrient digestibility of weaner rabbits fed with diets containing bamboo leaf meal. Nigerian Journal of Animal Production, pp. 52-58

[9] Makinde, O. J., Ibe, E. A. and Ajibade, A. J. (2015). Response of Growing Rabbits to Concentrate Diet Supplemented with Leucaena (Leucaena leucocephala) or Siratro (Macroptilium atropurpureum) Leaves. Department of Animal Production Technology, Federal College of Wildlife Management, PMB 268, New Bussa, Niger State, Nigeria Journal of Biology, Agriculture and Healthcare ISSN 2224-3208

[10] Nakajima, Y., Yun, Y. S. & Kunugi, A. (2003). Six new flavonolignans from Sasa veitchii (Carr.) Rehder. Tetrahedron, 59 (40): 8011- 8015.

[11] Owen, O. J., Chukuigwe, E. C., Amakiri, A. O. and Aniebo, A. O. (2008). Bamboo hutches as replacement for wire mesh cages in rabbit production in Nigeria. Livestock Research for Rural Development, 20:. Available at http://www.lrrd.org/lrrd20/11/owe n20177.htm

[12] Rathmod, J. D., Pathak, L. N., Patel, G. R., Jivani, N. P. & Bhatt, M. N. (2011). Phytophamacological properties of Bambusa arundinaceae as a potential medicinal tree: An overview. Journal of Appl. Pharm. Sc. 01(10): 27-31.

[13] Trocino, A., Garcia, J., Canabarro, R., Xiccafo, G. (2013). A metal analysis on the role of soluble fibre in diets for growing rabbits. World Rabbit Sci. 21, 1-15.

[14] Xiccaro, G., Trocino, A., Majolini, D., Fragkiadakis, M. and Razzoli, M. (2011). Effects of decreasing dietary protein level and replacing starch with soluble fibre digestive physiology and performance of growing rabbits. J. of Anim. Res. 1179-1187.

[15] Yahaya, M. A. and Wekhe, S. N. (2014). Additive impact of vitamin C and E on the gonadal hormones of adult rabbits in the humid tropics. Proceeding of the 39th Conference of Nigerian Society for Animal Production (NSAP). Babcock University, Ilishan–Remo, Ogun State.

[16] Yusuf, A. M., Garba, M. H., Olafadeham, O. A. and Okafor, C. I. (2009). Evaluation of the feeding potentials of Vitellariaparadoxum, Nauclealatifolia and Terminaliamacroptera foliage as supplements to concentrate feed for weaner rabbits. Proceedings of the 34thAnnual Conference of Nigerian Society for Animal Production (NSAP), Uyo; p. 306- 308.

[17] Zhang, Y., Bao, B. L., Lu, B. Y., Ren, Y. P., Tie, X. W. and Zhang, Y. (2005). Determination of flavone glucosides in antioxidant of bamboo leaves (AOB) fortified foods by reversed-phase high performance liquid chromatography with ultraviolet diode array detection . J. Chromatogr., 1065, 177-185.

[18] Zhang, Y., Chen, J., Zhang, X., Wu, X. & Zhang, Y. (2007). Addition of antioxidant of bamboo leaves (AOB) effectively reduces acrylamide formation in potato crisps and French fries. Journal of Agricultural and Food Chemistry, 55(2): 523-528.