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EFFECT OF FEEDING SUN-DRIED NEEM (*Azadirachta indica*) LEAF MEAL ON GROWTH PERFORMANCE AND ECONOMIC OF PRODUCTION OF WEANER RABBITS

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Abstract: A twelve week feeding trial was conducted to evaluate the effect of Neem leaf meal (NLM) on growth performance and economic of weaner rabbits. Five treatment diets were formulated with (T_1) 0%NLM, (T_2)5%NLM, (T_3)10%NLM, (T_4)15%NLM, (T_5)20%NLM.Thirty mixed breed of both sexes weighing 477.00-478.30g were divided into 5 groups of 6 replicates per group and each randomly assigned to the 5treatment diets in a completely randomized design. Results of the leaf meal for proximate composition showed that NLM had 96.04% Dry matter, 41.13 % NFE, 23.96% CP, 14.69%Fat, 7.61% CF, and 7.49% ash, Amino acid profile showed all nutrient present with Glutamic acid (22.56) highest value and Nor-leucine completely absent. Results obtained also revealed that there were significant ($P<0.05$) differences in final weight and daily weight gain across the treatment groups while daily feed intake, FCR, daily protein intake and protein efficiency ratio were similar ($P>0.05$) across treatment means. Feed cost reduced as the inclusion of the NLM increases in the diets, while cost per unit weight gain was negatively affected by the inclusion of the NLM. It was therefore concluded that neem leaf meal affected performance negatively but not risky to the health of rabbits, and recommended that inclusion of neem leaf meal up to 15% in the diets of rabbits can improve rabbit production and save cost for farmer.

Keywords: Neem leaf, rabbit, growth performance, economic of production.

I. Introduction

In most developing countries, the livestock industry keeps having difficult in supplying the much needed animal protein to the populace. This has largely been due to the high cost of livestock feeds. Generally, livestock play important roles in the nation's socio-economic development and contribute towards household food and nutritional security (Okeke and Akubukor, 2014). Rabbit production is still a new enterprise and mainly a small-holder system that has advantages over the other livestock system, because of the small rabbit's body size, high rate of reproduction, adaptability to inexpensive housing and useful by-products (Owen *et al.,* 1977). Inadequate food production is a critical problem throughout Africa and rabbit farming could make a significant contribution to human welfare in developing countries with inadequate food production (Owen *et al.,* 1977). Currently, most farmers focus on small livestock like poultry, swine, cavies (i.e guinea pigs) and rabbits; in response to the unfortunate situation.

Livestock production generally is affected by inadequate and high cost of feed ingredients brought about mainly by the stiff competition between man and animal for grains and oil seeds (Agunbiade *et al.,* 2002). Cost of livestock feed is high, thus causing a high cost of animal production. Cost of feeding livestock accounts for about 70% the cost of total cost of livestock production (Oluremi *et al.,* 2008).A distinctive gap therefore exists between the requirement and supplies of nutrient for livestock. Animal nutritionists in collaboration with livestock producers have thus intensified research into less costly and readily available alternative feed materials (Orayaga *et al.,* 2016). The search for alternative feed ingredients continue to attract the attention of researchers especially in the developing countries of the world for future hopes of feeding the animals and safeguarding their food security will depend on the utilization of unconventional feed resources with less competition between man and animals (Safwat *et al.,* 2014).

The neem leaf is one possible unconventional feedstuff for rabbits. Utilization of neem leaf meal ingredient as alternative is not new but there are no established safe levels in diets (Esonu *et al.*, 2006). Based on these findings, unconventional feedstuffs such as plant leaves could play a vital role in alleviating these enormous challenges of rabbit production thus reducing the cost of production. Neem leaf meal is non-conventional feedstuff and could play a vital role in livestock production. Hence, it effect on the performance of growth rabbits will be investigated in this study.

II. MATERIALS AND METHODS

Experimental site

The study was conducted at the Rabbit unit of the Livestock Teaching and Research Farm, Federal University of Agriculture Makurdi, Benue State. Makurdi is located between latitude 7°44'N and Longitude 8°2 1 'E in the Guinea Savannah zone of West Africa. The location is characterized by two seasons; dry and wet season. Annual rainfall ranges from 508mm to 1016mm.The area is warm with minimum and maximum temperature of 24°C and *36°C* - respectively. The relative humidity is between 39.50+2.20 and 64.00±4.80% (TAC, 2009).

Source and Preparation of Neem Leaf Meal

Neem leaves were harvested from Akwanga Local Government Area in Nasarawa State. The leaves were sun dried to about 8% moisture, milled and stored to the time it was used. Other ingredients were obtained from the market in Makurdi, Benue State.

Experimental Diets

Five iso-nitrgenous and iso-caloric diets were formulated. Diet one which was the control had no NLM while the other diets had NLM at 5, 10, l5and 20% levels and were designated Dl, D2, D3, D4 and D5 respectively, (Table 1).

Chemical analysis

Proximate and amino acid profile of the test ingredient were determined according to the procedure described by (A.O.A.C, 2005).

Experimental Animals, Design and Management

Thirty (30) healthy weaner rabbits comprising of mixed sex and breed were purchased around Makurdi from small holder rabbit farmers and use for the feeding trial. The rabbits were randomly allocated to five treatment diets balancing for weight. Each treatment contained six rabbits with each making a replicate. Prior to the commencement of the feeding trial, the animals were allowed one-week (7days) acclimatization period. Data collection lasted for a period of 84 days during which feed and water were served *ad libitum.*

Table 1: Composition of experimental diets containing graded levels of neem leaf meal

Ingredients	T1	T2	T3	T4	T5
Maize	36.00	33.00	32.05	30.55	28.00
Neem	0	5.00	10.00	15.00	20.00
Maize offal	9.00	9.00	6.00	5.00	4.55
Rice offal	23.85	23.00	22.80	22.00	21.10
Blood meal	2.00	2.00	2.00	2.30	2.20
GNC	24.00	22.85	22.00	20.00	19.00
Bone ash	3.00	3.00	3.00	3.00	3.00
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
Table salt	0.30	0.30	0.30	0.30	0.30
Palm Oil	1.00	1.00	1.00	1.00	1.00
Total	100	100	100	100	100
Calculated Nutrients					
Crude Protein	18.02	18.07	18.14	18.06	18.10
ME (Kcal/kg)	2609.34	2601.47	2601.47	2611.45	2608.75
Crude Fibre	12.25	12.22	12.19	12.10	12.02
Calcium	1.50	1.50	1.50	1.50	1.50
Phosphorus	0.98	0.98	0.98	0.98	0.98
Either Extract	3.67	3.67	3.67	3.68	3.69

T1, T2, T3,T4, T5 = Treatment 1, 2, 3, 4, and 5, ME = Metabolizable Energy, GNC = Ground nut cake

Data Collection

Growth parameters (daily feed intake, daily weight gain, feed conversion ratio, protein intake and protein efficiency ratio) were determined by calculation as follow:

a. Daily feed intake; DFI = $\frac{\text{DFI}}{84}$

b. Feed conversion ratio (FCR): FCR = $\frac{\Sigma WF1 \Sigma WF1}{\frac{DFI(g)}{DWG\ (g)}}$

c. Daily weight gain (DWG) = $\frac{TWG}{84}$

d. Daily protein intake (DPI) = $\frac{DFI \times \%CP \text{ in diet}}{100}$

e. Protein efficiency ratio (PER) = $\frac{DWG}{DP}$

Economic of production

The prevailing market price of ingredients used during the period of the study was used for the economic appraisal of the feeds. The cost of the feed ingredients including services such as transportation and processing was used to compute the true cost of the feeds per Kg used in the study.

i. Cost of diet (/kg) = Summation of market price of each ingredient multiplied by the proportion of the ingredient in the diet.
ii. Feed cost (₦/kg weight gain) = Cost of diet(/kg) multiplied by feed conversion ratio
iii. Gross Margin was obtained as Mean market price of rabbits (Revenue) less Mean total cost of production (costs of feed, milling, labour, drugs and chemicals, housing and equipment and transportation.
iv. Cost to benefit ratio was calculated as the ratio of cost to benefit.

Data Analysis

All data generated were subjected to the analysis of variance (ANOVA) using SAS (SAS, 2000) where significant differences occurred, means were separated using Duncan New Multiple Range Test.

III. RESULTS AND DISCUSSIONS

Chemical composition of neem leaf meal (NLM)

The proximate composition of neem leaf is presented in Table 2.This result showed that neem leaf meal contain 96.04% DM, 23.96% CP, 14.69% Ether extract, 7.49% ash, 7.61% CF and 46.13% NFE. This was in contradiction to 90.37% DM, 18.90% CP, 6.26% fat, 7.92% ash, 33.77% CF and 33.15% NFE reported by Schofield *et al.* (2001). 93.89% DM, 18.16% CP, 3.53% fat, 13.07% ash, 11.33% CF and 53.91% NFE reported by Otache and Agbajor, (2017), (18.01% CP, 2.50% fat, 5.62% ash, 15.56% CF and 58.22% NFP), (Schofield *et al.* 2001), (85.70-87.90% DM, 1.22-4.04% CP, 2.89-3.18% fat, 3.88-4.03% ash, 9.09-10.86% CF for three different cultivars) reported by Otache and Agbajor, (2017) and (33.5%DM, 16.6% CP, 3.7% fat, 12.0% ash, and 16.8% CF) reported by Johnson and Morris (1996). These disparities could be as a result of different processing methods, age of harvest, mode of collection, environmental and climatic conditions. But this evidence also proved that neem leaf is of good nutritive value to rabbits when included in their diet.

Amino acid profile of neem leaf meal (NLM)

Amino acid profile of neem leaf meal is presented in Table 3. The result indicated that Methionine was the least concentrated amino acid in neem leaf (0.02%) while glutamic acid was the highest (5.19%). This result corresponds with the findings of Johnson and Morris, (1996) who reported a least concentration of methionine and other essential amino acids in forages. Katsanda *et al.,* (2018) observed a higher concentration of aspartic acid and lower concentration of cysteine in mucuna, cowpea and silver leaf desmodium forages, this agrees with this study as aspartic acid was the second highest in concentration and cysteine as one of the lower concentrated amino acids in neem leaf used. None of these authors mentioned above reported a presence of norleucine (an isomer of leucine) as observed in this study. NRC, (2001) consider lysine and methionine as the two essential limiting amino acids and reports that most feedstuffs have low lysine and methionine concentrations, this was in agreement with the observation on methionine in neem leaf used in this study. There were no found reports on amino acids concentration of NLM at the time of this study, the concentration of amino acids found in NLM of this study was compared to other leaf meals used in livestock feeding.

The amino acid profile of the test diets used in this study is presented in Table 3.

Table 2: Proximate composition of test ingredient (neem leaf meal)

Parameters	Value (%)
Dry Matter	96.04
Crude Protein	23.96
Crude Fibre	7.61
Ether extract	14.96
Ash	7.49
NFE	46.13

NFE = Nitrogen Free Extract

Table 3: Amino acid profile of neem leaf meal

Amino acids	Conc. g/100g protein	Conc. % Samples NLM
Luecine	8.23	1.89
Lysine	4.53	1.04
Isoleucine	3.99	0.92
Phenylalanine	3.19	0.73
Nor-leucine	-	-
Tryptophan	1.10	0.25
Valine	6.31	1.45
Methionine	0.11	0.02
Proline	3.65	0.84
Arginine	5.93	1.36
Tyrosine	1.38	0.35
Histidine	2.30	0.53
Cystine	2.54	0.58
Alanine	6.98	1.61
Glutamic acid	22.56	5.19
Glycine	7.93	1.82
Threonine	4.30	0.99
Serine	6.92	1.59
Aspartic acid	9.12	2.09.

-=Absent, NLM= Neem Leaf Meal, %=Percentage

Growth performance of rabbits fed graded levels of diets containing neem leaf meal (NLM)

The result of growth performance presented in Table 4revealed significant ($P < 0.05$) differences in final weight and daily weight gain across the treatment groups. It was observed that rabbits in the control diet had a relatively higher final body weight (1550.00 g),daily weight gain of 12.77 g. Daily feed intake, feed conversion ratio, daily protein intake and protein efficiency ratio were similar ($P>.0.05$) across treatment means. The final weights obtained in this study, though significantly different, did not follow a definite pattern. These values were however higher than the findings of Unigwe *et al.,* (2013) when graded levels of neem leaf meal was fed to rabbits. Similarly, the daily weight gain reported in this study was higher than those reported by (Unigwe *et al.,* 2013). The average daily feed intake reported in this study was not significant ($P > 0.05$) across treatment means. These values were lower than the values (80 – 90 g) reported by (Oluremi *et al.,* 2008). Similarities observed in feed intake suggest that all diets were palatable and thus acceptable by the rabbits as the inclusion of neem leaf meal at varying levels did not depress feed consumption, this is in line with the report of Ani and Adigegwu, (2005) who stated that the quantity of feed intake in rabbits is dependent to a large extent on the palatability of the feed, and in the crude fibre content of the feed with an increasing effect on nutrient availability and subsequently, the appetite thereby giving a higher feed intake. Feed conversion ratio of this study (3.69 - 4.75) was better than the value reported by (Adekojo, 2014). The observation on daily protein (7.41 – 8.73 g/d) intake per rabbit contradicts the value of (4.97 - 8.43 g) reported by Adekojo, (2014) who fed weaned rabbits with graded levels of dried citrus pulp. Protein efficiency ratio observed in this study was comparable to (0.54 - 1.46) reported by Adejumo, (2006) who fed rabbits with graded levels of cassava peels, leucaena and gliricidia leaves based diets. Differences observed in this study with previous researchers could be attributed to differences in experimental diets, procedure, age, sex, breed of animals and different test ingredients used.

Economics of production of rabbits fed diets containing graded levels of neem leaf meal (NLM)

Cost of feed consumed per rabbit decreased as the inclusion of the test ingredient increased, this was in line with the findings of Ajayi et al., (2007) who fed diets containing graded levels of blood-wild sun flower leaf meal mixture to weaner rabbits. Feed cost per kg weight gain was better off on rabbits fed T_2 diets which was also higher than the control diet (T_1) but cost per kg weight gain did not reduce as the inclusion of the test ingredient increases as reported by (Ajayi *et al.,* 2007; and Iyeghe-Erakpotobor *et al.,* 2006). The cost-benefit of feed per rabbit was better in rabbits on T_2, this include that rabbits fed 5 % inclusion of neem leaf meal in diet can be raised at a cheaper cost, achieving profit.

Table 4: Growth performance of rabbits fed diets containing graded levels of neem leaf meal (NLM)

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Initial wt. (g)	477.00	471.20	475.00	478.00	478.30	14.23
Final wt. (g)	1550.00^a	1323.00^b	1315.50^b	1533.00^a	1320.50^b	45.98
Daily wt. gain(g)	12.77^a	10.14^b	10.01^b	12.56^a	10.03^b	0.46
F.C.R	3.88	4.75	4.21	3.69	4.58	0.18
Daily protein intake (g)	8.73	8.47	7.41	8.16	8.09	0.22
PER	0.74	0.86	0.69	0.66	0.78	0.03

^{ab} means on the same row with different superscript is significant, FCR = Feed Conversion Ratio, NFE = Nitrogen Free Extract, PER = Protein Efficiency Ratio, T1 = 0% NLM (Control), T2 = 5% NLM, T3 = 10% NLM, T4 = 15%, T5 = 20%

Table 5: Economics of production of rabbits fed diets containing graded levels of neem leaf (NLM)

Parameters	T1	T2	T3	T4	T5
Cost of feed consumed/Rabbit(₦)	559.68	534.20	492.58	456.28	472.85
Cost/Kg weight gain (₦ (kg)	486.28	617.62	489.18	445.37	479.03
Total cost of production (₦)	1468.3	1429.5	1391.5	1369.4	1359.9
Revenue (₦)	2546.8	2253.6	2912.8	3041.6	2927.6
Gross Margin (₦)	1781.5	1224.2	1321.6	1672.1	1636.2
Benefit cost of feed/Rabbit	1.17	0.75	1.09	5.39	4.29

NLM=Neem Leaf meals

T1=0% NLN (Control), T2=5% NLM, T3=10% NLM, T4=15% NLM, T5=20% NLM

IV. Conclusion and Application

1. From this study, the proximate composition of the neem leaf meal (NLM) was adequate to meet nutrient requirements of the rabbits, but also contains some anti-nutrients. The study reveals that neem leaves could serve as a good source of nutritional supplement in the diet of rabbits.
2. Growth performance of rabbits was slightly affected with the inclusion of neem leaf meal up to 20%.
3. The coefficient of digestibility of the various nutrients are indication that the Nutrient available in neem leaf meal (NLM) were available for growth and Maintenance.
4. The economic analysis revealed that inclusion of neem leaf meal (NLM) in the rabbit diets, resulted in higher profit and lower cost of production.

REFERENCES

[1]. Okeke, J. J and Akubukor, F. C. (2014). Preliminary study on the nutrient digestibility of rabbits (Oryctologus cuniculus) fed on stem and leaves fractions of sweet potatoe in cativity. *America Journal of life science. 2(4); 499-505.*

[2]. Owen E. C. West, D. W. and Coates M. E. (1977). Metabolism of riboflavin in germ-free and conventional rabbit Dr. *Journal of. Nutrition*.24:759-267.

[3]. Agunbiade. J. A. Bello, R. A. and Adeyerni, O. A. (2002). Performance Characteristics of weaner rabbits on cassava peels based balanced diets. *Nigerian Journal of Animal Production 29:171 - 175.*

[4]. Oluremi, O. I. A., Mou, P. M .and Adenkola, A. Y. (2008). Effect of fermentation of sweet orange peels on its maize replacement value in broiler diets. Livestock Research for Rural Development. 26 (5).

[5]. Orayaga, K. T., Ayoade, J. A., Dosa, J. J. (2016). Effects of three sources of groundnut (Arachis hypogea) meal on carcass yield, internal organs and meat quality of rabbits. *Journal of Animal Production Advances, volume 6(9), pages 991 - 998.*

[6]. Safwat, A. M., Sarmiento-Franco, L., Santos-Ricalde. R. and Nieves, D. (2014). Effect of dietary inclusion of leucaena leucocephala and Moringa oleifera leaf meal supplementation and performance of small East African goats fed native pasture hay basal forages. Small Ruminant Research 10(2-3): 165-173.

[7]. Esonu, B. O., M. N. Opara, I. C. Okoli, H. O. Obikaonu, C. Udedibe and O. M. Iheshular. (2006). Physiological responses of laying birds to neem (Azardirachta indica) leaf meal based diets, body weight, organ characteristic and haematology.

[8]. Tactical Air Command (TAC), (2009). Tactical Air Command Meteorological Data. Nigeria Air Force Makurdi.

[9]. A.O.A.C. (2005). Official Method of Analysis (18th Edition). Association of Official Analytical Chemist International, Maryland, U.S.A.

[10]. SAS (2000). Statistical analysis software. Guide for personal computer Release 8.1 SAS Institute Inc., Cary, NC, USA.

[11]. Otache,M.A. and Agbajor, G.K.(2017). Proximate and mineral composition of leaves of *Azadirachta indica*. *Inter-national journal of current research in chemistry and pharmaceutical sciences. 4(11) pgs. 50-54*

[12]. Johnson, J. K and Morris, D.D. (1996). Alteration in blood protein, Textbook of International Animal Medicine (second edition). Mosby Publisher, United States of American, Pp. 128-139.

[13]. Miranda L.F., Rodriguez N. M., Pereira, E.S., De Quieroz, A. C., Sainze, R. D., Pimentel P. G. and Neto, M. M. G (2012). Chemical composition and ruminal degradation kinetics of crude protein and amino acids, and intestinal digestibility of amino acids from tropical forages. *Revista Brasileira de Zootecnia, volume 41 (3). Pages 717-725*

[14]. Katsande, S., Baloyi, J. J., Nhereva-Chokuda, F., Ngongoni, N. T., Gusha, J. and Matope, G. (2018). Degradability of amino acids in selected legume forages using the in- situ nylon bag technique. *African journal of Range and forage science. Volume 35 (2), pages 131-135.*

[15]. National research council (NRC) 2001. Nutrient requirements of dairy cattle. 7th edition, Washington DC: National Academy press, 2001. Page 356.

[16]. Unigwe, C. R, Balogun, F, Okorafor, U. P., Odah, Abonyi, F and Olona, J. F. (2003). Effect of neem leaf (Azadiractaindica) meal on growth performance and haematology of rabbits. World scientific news.

[17]. Ani, A. O. and Adigegwu, L. I. (2005). The feeding value of velvet beans (Mucuna prurients) to weaner rabbits. Proceedings of the 30 Annual Conference of Nigeria Society of Animal production, March 20 24 2005, University of Nsukka, Enugu, Nigeria, pages 186-189.

[18]. Adekojo, S. A., Adama, T. Z. Aremu A., Ijaiya A. T., Owoleke, O. E. and Ibrahim A. (2014). Effects of dietary inclusion of differently processed leucaena leaf meal on carcass characteristics of rabbits. *International journal of food science and nutrition Engineering*, volume 4, Issue 5, pages 118-127.

[19]. Adejumo, D. O. (2006). Performance and serum chemistry of rabbits fed graded levels of cassava peels, Leucaena leucocephala and Gliricidia sepium leaves based diet. *Global journal of pure and applied sciences* 12 (2) pgs. 171-175.

[20]. Ajayi, A. F., Farimu, G. O., Ojebiyi, O. O. and Olayemi, T. B. (2007). Performance evaluation of male weaner rabbits fed diets containing graded levels of blood-wild sunflower leaf meal mixture. *World Journal of Agricultural Sciences. 3(2) Pp. 250-255*

[21]. Iyeghe-Erakpotobor, G. T, Osuhor, C. U and Olugbemi, T. S (2006). Performance and digestibility of weaner rabbits fed graded levels of soybean cheese waste/maize offal diet and brachiaria grass hay. African Journal of Biotechnology 5(17), Pp. 1579-1583

[22]. Ani, A. O. and Adigegwu, L. I. (2005). The feeding value of velvet beans (Mucuna prurients) to weaner rabbits. Proceedings of the 30thAnnual Conference of Nigeria Society of Animal production, University of Nsukka, Enugu, Nigeria, Pp. 186-189.