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Effect of feeding some evergreen tropical browse plant leaves on performance, digestibility and economic analysis of growing rabbits

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Target audience: *Animal Scientist, Feed Millers, Farmer*

Abstract

A feeding trial was conducted with thirty (30) weaner rabbits to investigate the nutritive potentials of some evergreen tropical browse plant leaves (Ficcus thoningii, Vitex doniana, Daniela oliveri, Sarcocephalus latifolia). Mixed breed rabbits were used and randomly assigned to five (5) treatments (T_1 - T_5). The rabbits in Treatment 1 were fed concentrate only (control), while those in T_2 - T_5 were fed as follows; Treatment 2: Ficcus thoningii + concentrate of 3% weekly body weight, Treatment 3: Vitex doniana + concentrate of 3% weekly body weight, Treatment 4: Daniela oliveri + concentrate of 3% weekly body weight, Treatment 5: Sarcocephalus latifolia + concentrate of 3% weekly body weight. The rabbits were fed and given drinking water ad-libitum for the twelve-week experimental duration during which their performance, nutrient digestibility, and economic analysis were evaluated. Experimental diets depressed all the growth parameters measured; average daily feed intake was in the range of 62.67 to 90.17g while average final weight range was 1440.83-1766.67g. Coefficient of digestibility by rabbits was significantly depressed. The diet also affected the economics of production such that feeding of dietary treatments resulted in positive net revenue of ₦ 459.56 to ₦ 628.59 per rabbit. The cost per kg of each treatment feed (₦70.61 to ₦71.11) was lower in the control diets (₦70.61) than the browse plant diet (₦71.11). The study had shown that the control diet was better in all the parameter measured.

Key words: *Digestibility, Economic Analysis, Browse Plant, Performance and Rabbits.*

Description of Problem

Feed supply has remained the single most important aspect and a major constraint in animal production in terms of quality and quantity due to increasing cost of feedstuff brought about by the competition between man and his animals for energy sources (1). Feed account for the dominant inputs in animal production ranging from 65 – 85% of total cost of production (2, 3). Thus livestock farmers in developing countries are faced with these challenges leading to considerable fall in the production of certain livestock species such as rabbits, poultry and pigs.

It was reported by (4) that the interest of animal scientist in recent years has been the search for cheaper locally available and nutritionally viable alternative feedstuff. Recent study by (4), on the potential of plant leaves as diet for livestock have shown significant growth responses by animals fed such leaves. Such leaves have been shown to yield relatively higher levels of crude protein and minerals with lower crude fibre levels than tropical

grasses (4). They are also gaining acceptance as feedstuff in livestock diet and are considered to be non-conventional feeding materials. There is need therefore to search for locally cheap sources of feed that are readily available particularly those that do not attract competition in consumption between humans and livestock but have direct relevance in human food channel (5).

Even though the bulk of their weight is water, leafy vegetable represents a veritable natural pharmacy of minerals, vitamins and phytochemicals (6). He concluded that the potassium content of leafy vegetables is good in the control of diuretic and hypertensive complication in animals because it lowers arterial blood pressure. Vegetables like *Ficcus thoningii, Vitex doniana, Daniela oliveri, Sarcocephalus latifolia* are important sources of protective foods, which are highly beneficial for the maintenance of good health and prevention of diseases (6).

Reports from (7) showed that during the dry season when rainfall and plant growth is limited, there is often real shortage of feeds coupled with poor quality, to ease this situation of low protein intake of animal origin, there is need to increase production of small highly prolific livestock with rapid turnover rate at a very low cost, one of such animals is the rabbit. Rabbit production has a considerable potential in developing countries in alleviating the low animal protein intake for the supply of the much needed protein due to the low capital investment and space requirement, short generation intervals, rapid growth rate, high reproductive potential and ability to utilize the abundant browse plant leaves and fibrous materials (8; 9).

The study was conducted, to investigate the utilization of some evergreen tropical browse plant leaves (*Ficcus thoningii, Vitex doniana, Daniela oliveri, Sarcocephalus atifolia*) in rabbit diets on growth performance, nutrient digestibility and economics of production.

Materials and Methods

Experimental Site

The experiment was carried out at the Teaching and Research Farm of the Federal College of Education Obudu, Cross River State. The Farm is located at the Department of Agriculture site in Obanliku. Obanliku is located in the northernmost part of Cross River State, with height of 74.5m above sea level, between longitude $6^0$37" North and latitude $9^0$13" East within the Tropical Savannah region of Nigeria (10; 11). It is characterized by two distinct seasons, the wet season and the dry season. The wet season starts from early April to early November while the dry season starts from middle November to March. The area is warm with ambient temperature range between 20.5^0C to 30.7^0C having an annual rainfall of about 4300mm to 4500mm. Relative humidity changes between 57% in February/March and 89% in August/September.

Source of the Browse Plant Leaves

Sarcocephalus latifolia, Vitex doniana and *Daniela oliveri* were all harvested along the College Farm road while *Ficcus thoningii* was harvested from villages surrounding the Farm.

Experimental Diets

The Experimental browse plant leaves were harvested and wilted over night to reduce moisture content, weighed and fed fresh each morning to the

experimental animals as follows:
Treatment 1: concentrate only (control)
Treatment 2: *Ficcus thoningii* + concentrate of 3% weekly body weight
Treatment 3: *Vitex doniana* + concentrate of 3% weekly body weight
Treatment 4: *Daniela oliveri* + concentrate of 3% weekly body weight
Treatment 5: *Sarcocephalus Latifolia* + concentrate of 3% weekly body weight.
Experimental diet was formulated as shown in Table 1.

Table 1: Ingredient and Nutrient Composition of concentrate diets (%)

Ingredient	% Inclusion
Maize	46.70
Rice offal	22.90
Full fat soyabean	19.07
Groundnut cake	9.53
Bone ash	2.00
Common salt	0.25
Premix	0.25
Methionine	0.10
Lysine	0.10
Total	100.0
Analyzed Nutrient Composition (%)	
Dry Matter	91.23
Crude Protein	18.00
Ether Extract	4.95
Crude Fibre	11.00
Ash	9.55
NFE	47.03
DE(Kcal/kg)	2740.48

Each 1kg of vitamin/mineral premix manufactured by BEAUTS Co. Inc. Man, U.S.A., contains Vitamin A 220,000, Vitamin D 66,000, Vitamin E 44, 014; Vitamin K 88 mg; Vitamin B 12; 0.76 mg; Niacin 1122 mg, Calcium 27%, Phosphorus 10%, Iron 0.6%, Zinc 0.35%, manganese 0.25%, Copper 0.06%; Iodine 0.002%, Cobalt 26 ppm, Selenium 4pp. ME = Metabolizable Energy

Management of experimental animals and design

A total of thirty (30) mixed breed (California, chinchilla, New Zealand), weaned rabbits with average weight of 365.0g of both sexes were used for the experiment. The rabbits were obtained from a local farmer in Makurdi. The rabbits on arrival were allowed a preliminary feeding period of seven days for acclimatization. They were then weighed and randomly allocated to treatments. The rabbits were assigned to five (5) dietary treatments with six (6) replicate each in a Completely Randomized Design (CRD). Each rabbit in a treatment served as a replicate and were housed individually in wire mesh hutches measuring 60 x 40 x 40 cm containing a feeder and a drinker. Keprocryl was administered as an antibiotic against pathogenic infections. Standard health and sanitation procedures were strictly observed during the experimental period.

Chemical Analysis

The proximate analysis of *Ficcus thoningii*, *Vitex doniania, Daniela olveri,* and *Sarcocephatus latifolia* and experimental diet was conducted according to (12).

Anti-nutritional factors of the browse plants leaves

Phytate in the leaves was estimated as phytic acid using the method of (13) and by titration method described by (14). Saponin was determined gravimetrically by the method of (15) as reported by (16), (17). Oxalate was determined titrimetrically as described by (18), Tannin was determined using the methods described by (19). Alkaloid was determined by the method described by (20).

Experimental procedure/parameters measured

Data were collected on the following parameters:

Average daily Feed Intake (FI)

The rabbits in each treatment were fed weighed amounts of their group diets daily and fresh water given *ad-libitum*. Feed intake was determined by obtaining the differences between the quantity of feed offered and the left over weekly. The average daily feed intake of all the rabbits was obtained by dividing the total feed intake of the rabbits during the period under study by 84 days.

Average daily Weight Gain (ADWG)

The animals were weighed at the beginning of the experiment and weekly thereafter to obtain the weekly weight in order to determine the growth rate. Subtracting the initial weight from the final weight of each rabbit and dividing by 84 days gave the average daily weight gain per rabbit.

Feed Conversion Ratio (FCR)

FCR was calculated as the ratio of average daily feed intake to average daily weight gain.

FCR = Weight of feed intake/Weight gain

Digestibility Trial

At the end of the feeding trial, three (3) rabbits, with live weight approximating their treatment average live weight, were selected from each treatment and used for the digestibility trial. Faecal collection lasted for five (5) days. During this period, the rabbits were fed 75% weight of their daily feed intake per day since the level of feed intake increased the rate of passage of digesta from the GIT and thus reducing the digestibility of nutrients (21). Pieces of nylon net were tied under individual hutches for daily faecal collection. Before the commencement of faecal collection the rabbis were deprived of feed for 18 hours to ensure that faecal collection corresponded to the feed offered. The fresh faeces from each replicate were collected weighed and oven-dried at 80ºC for 24 hours, the oven-dried faeces per replicate was also weighed. At the end of the digestibility study, collected faeces from each replicate were bulked, thoroughly mixed together and ground. Samples of the ground faeces were stored in airtight sample bottles for chemical analysis.

After chemical analysis the digestibility coefficient was calculated using the following equation

Apparent digestibility = [Nutrient in Feed – Nutrient in Faeces/ Nutrient in Feed] × 100

Economics of production:

The cost per kilogram feed and the cost of processing of each experimental diet were determined based on the current prices of feed ingredients in Obanliku. The cost of feeding the rabbits on a particular diet for the period of the study was also calculated as the product of the cost per

kilogram of the diet and feed intake. Feed cost/kg weight gain was also calculated by dividing the Cost of feed intake/rabbit (₦) by the Average total weight Gain (kg). The net profit was computed as the selling price of table rabbit less the total cost of production. Consideration was given to cost of medication, labour and depreciation of asset (housing, feeder and drinker).

Statistical Analysis:

All data obtained were subjected to Analysis of Variance (ANOVA) using (22)

Results and Discussion

Proximate Composition of experimental browse plants leaves

The proximate composition of experimental browse plant leaves is shown in Table 2. The range of crude protein of 8.75 to 18% reported of the browse plant use in the experiment was within the range of 5.00 to 35.00% reported by (23) for tropical forages and is also within the range reported by (24) of 7.00 to 28% for most forages. The CF range of 7.32 to 22.08 was a bit lower than the value 9.00 to 30.0% obtained by (23) and that reported by (24) of 9.0 to 37%. The EE range of 2.00 to 6.41% present in experimental forages was also within range of 1.5 to 12.00% reported by (24). These differences could be attributed to variations in location and varieties of forages.

Table 2: Proximate composition of experimental browse plant leaves

Parameters (%)	(*Ft*)	(*Vd*)	(*Do*)	(*Sl*)
Dry Matter	92.28	93.21	92.52	90.22
Crude protein	17.47	13.10	8.70	8.75
Ether Extract	2.65	4.63	6.41	2.00
Ash	15.35	7.78	10.08	5.09
Crude Fibre	22.08	11.17	14.47	7.32
Nitrogen Free Extract	65.27	56.53	52.86	67.06
*ME (Kcal/kg)	3180.25	2870.25	2722.77	2867.98

Ft= Ficcus thoningii, *Vd = Vitex doniana*, *Do = Daniela oliveri*, *Sl = Sarcocephalus latifolia*;
*ME= Metabolizable Energy obtained using the formula recommended by (25) i.e. ME = (37 x %CP) + (81.8 x %EE) + (35.5 x %NFE)

Anti-nutritional factors of experimental browse plants leaves

Anti-Nutritional factors of experimental browse plant leaves are shown in Table 3. The percentage components of anti-nutritional factors in this present study were low but comparable with the reports of (9) and (26). Among the anti-nutritional factors, the tannin content of 1.22, 2.34, 5.1 and 0.34 obtained in *Ficcus thoningii*, *Vitex doniana*, *Daniela oliveri*, and *Sarcocephalus latifolia* respectively were comparable to values (0.13 to 6.31%) reported previously by (6). A threshold concentration of 5% tannin had been reported above which there is rejection of browse plants by goats (27). The phytin levels reported in this study ranged from 0.42 to 4.02 mm/100g, which is lower than the 13.80 to 25.20mm/100g reported by (28) for the south-eastern browses in Nigeria. These levels are unlikely to have any adverse effects on animals.

The oxalate content of the browse species was not consistent with the

reported values (1.49 to 5.79%) of some browse plants relished by ruminants in Nigeria (29). Oxalate content in this present study was low. It has been reported that 20g/kg oxalate can be lethal to chicken (30).

The saponin content of 0.002-2.55 mm/100g was also low as in other leguminous browse species. Report from (15) shows values of 3.24% and 3.47% for *Parkia biglobosa* and *Afzelia africana* respectively. Feedstuffs containing saponin had been shown to be defaunating agents (31). Cheeke (32) reported that saponin has effect on erythrocyte haemolysis, reduction of blood and liver cholesterol, depression of growth rate, bloat (ruminant) inhibition of smooth muscle activity, enzyme inhibition and reduction in nutrient absorption. Saponins have been reported to alter cell wall permeability and therefore, to produce some toxic effect when ingested (33). The anti-nutritional effects of saponins have been mainly studied using alfalfa saponins. (34) observed that 4-7 weeks of *ad libitum* feeding of *albizia* gave rise to toxic manifestation in sheep. Symptoms include listlessness, anorexia, weight loss and gastro-enteritis. The toxicity of saponins can be reduced by repeatedly soaking the feed in water, though the level recorded in this present study may not pose any problem to the animals.

Table 3: Anti-Nutritional factors of experimental browse plant leaves

Anti-nutrient (mm/100g)	(*Ft*)	(*Vd*)	(*Do*)	(*Sl*)
Tannin	1.22	2.34	5.1	0.34
Phytate	4.02	0.18	-	0.42
Oxalate	12.3	0.39	-	-
Saponins	3.60	-	0.002	1.25
Alkaloids	-	0.89	0.001	2.38

Ft= Ficcus thoningii, *Vd = Vitex doniana*, *Do = Daniela oliveri*, *Sl = Sarcocephalus latifolia*, (-) = not present

Performance of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

The data on feed intake, weight gain and feed conversion ratio and mortality rate are presented in Table 4. Results on the growth performance of rabbits revealed that average daily feed intake was high in the forage groups than the control group, this high feed intake is probably due to low levels of energy content in the forage which make the animal to consume more when compared to the control to meet their body demand. These results agree with the finding of (35), who reported that animal increase their feed intake to meet up their energy requirement.

The figures reported here (12.91 to 17.96 g/day/rabbit) for average daily gain were lower than 18.20 to 19.20g/day/rabbit reported by (36) but they fall within the range of 10 to 20 g/day/rabbit which (8) found to be normal for most rabbits reared in the tropical environment. The daily weight gains reported in this study are higher than the values 8.43-10.38g/d recorded by (9) for rabbit fed raw and cooked *Delonix regia* seed meals. This difference is attributed to the high temperatures in the tropics.

The feed conversion ratios obtained in this study were higher than 3.08 to 3.69 reported by (37) and also not in agreement with the values 4.81 to 6.0 obtained by (38). The rabbits in T_1 diet had a better FCR (3.82) than the forages (7.96 to 9.29). From these results, it can be suggested that FCR was slowed by the dietary supplementation of forages. These results do not agree with previous findings reporting that dietary inclusion of many agriculture by-products including carrot-top or maize cobs, dried watermelon, wheat bran or beet pulp, pea vines hay or pea pods hulls have resulted in better FCR values as fed to rabbits (39; 40; 41 and 42).

Table 4: Performance of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

Parameters	T_1 (control)	T_2 (*Ft*)	T_3 (*Vd*)	T_4 (*Do*)	T_5 (*So*)	SEM	P value
Av. Initial Weight (g)	353.3	355.0	355.0	356.7	356.7		0.999
Av. Final Weight (g)	1766.7^{a}	1530.0^{b}	1503.5^{b}	1440.9^{b}	1454.2^{b}	37.82*	0.000
Av. DFI (g)	62.7^{b}	90.2^{a}	89.8^{a}	90.0^{a}	88.9^{a}	2.45*	0.000
Av. DWG (g)	17.9^{a}	14.1^{b}	14.0^{b}	12.9^{c}	12.1^{c}	0.43*	0.000
FCR	3.82^{c}	7.96^{ab}	7.80^{b}	9.25^{a}	9.29^{a}	0.57*	0.000
Mortality	0	0	0	0	0		

Ft= Ficcus thoningii, *Vd = Vitex doniana*, *Do = Daniela oliveri*, *Sl = Sarcocephalus latifolia*, ^{abcde} Mean on the same row with different superscripts are significantly different ($p<0.05$), Av. = Average, DWG = Daily Weight Gain, DFI = Daily Feed Intake, FCR = Feed conversion Ratio, SEM = Standard Error of Mean, *= Significant difference ($p<0.05$)

Coefficient of digestibility of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

The Coefficient of digestibility by rabbits fed concentrate diets and some browse plant leaves is presented in Table 5. The values of DM which varied from 40.80 to 75.15% was moderately high, they were however, lower than 74.14 to 83.35% (43) and comparable to the 61.64 to 64.97% reported by (42) when rabbits were fed dietary pea vines hay and pea pods hulls partially or completely replacing clover hay. The high coefficient of digestibility of crude protein of the diet in T_1 and T_2 (88.77% and 74.50%) respectively could be attributed to better utilization of concentrate and *Figus thoningii* by rabbit. Similar results were reported by (44) while (45) reported a lower CP digestibility range of 70.35-75.43% for growing rabbits fed dietary olive cake up to 20%, while the lower coefficient of digestibility of crude protein of the diet in T_3, T_4 and T_5 could be attributed to poor utilization of *Vitex doniana, Daniela oliveri* and *Sarcocephalus latifolia.* The high coefficient of digestibility of Ether Extract in T_1 and T_2 is an indication that rabbits can utilize dietary fat effectively as reported by (46) and (47), while the coefficient of digestibility of Ether Extract in T_3, T_4 and T_5 were observed to be lower than 88.90-91.40% reported by (48) when sweet orange pulp meal was fed to rabbits, also the range was higher than the 65.00-70.00% reported by (49) when sweet orange rind was fed to rabbits.

The coefficient of digestibility of crude fibre values were higher than the values 33.1 to 40.53 reported by (42) for Bouscat rabbits fed pea vine hay. Fibres from different sources could vary in

digestibility depending on the proportion of cellulose, hemicelluloses and lignin. The NFE in the experimental diet which represent the readily available carbohydrate recorded a moderate coefficient of digestibility (43.89 to 67.52%). This may suggest that the dietary forages did not have adverse effect on the readily available carbohydrate, since the coefficient of digestibility of NFE of the control group is within the range of other forage group.

Table 5: Coefficient of digestibility of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

Parameters	T_1 (control)	T_2 (*Ft*)	T_3 (*Vd*)	T_4 (*Do*)	T_5 (*Sl*)	SEM	P value
Dry Matter	75.15^{a}	55.32^{b}	55.40^{b}	49.54^{b}	40.80^{b}	4.23*	0.007
Crude protein	88.77^{a}	74.50^{b}	49.34^{c}	46.93^{c}	43.44^{c}	2.69*	0.000
Ether Extract	95.89^{a}	85.35^{ab}	70.14^{c}	76.74^{bc}	56.30^{d}	3.59*	0.001
Crude Fiber	49.88	62.59	43.75	40.29	54.36	6.89	0.359
Nitrogen Free Extract	65.23	67.52	43.89	46.74	55.31	7.37	0.260

Ft= Ficcus thoningii, *Vd = Vitex doniana*, *Do = Daniela oliveri*, *Sl = Sarcocephalus latifolia*,, ^{abcde} Mean on the same row with different superscripts are significantly different ($p<0.05$), Av. = Average, SEM = Standard Error of Mean, *= Significant difference ($p<0.05$)

Economic analysis of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

The economic analysis of rabbits fed concentrate diet and some evergreen tropical browse plant leaves is presented in Table 6. Feeding dietary treatments resulted in a positive net revenue of ₦ 459.56 to ₦ 628.59 per rabbit. The cost per kg of the experimental diet was lowest in T_1 diet (₦70.61), this low feed cost in T_1 control diet however translated to higher profit (₦628.59) than the forage groups. This result does not agree with the findings of (40) who found that peanut hay inclusion to replace clover hay contributed in lowering the feeding cost and increased the profit. Similarly, Economic utilization is one of the major reasons advanced by (50) for the use of alternative feeds.

Table 6: Economic analysis of rabbits fed concentrate diet and some evergreen tropical browse plant leaves

Parameters	T_1 (control)	T_2 (*Ft*)	T_3 (*Vd*)	T_4 (*Do*)	T_5 (*So*)
Feed cost per Kg (₦)	70.61	71.11	71.11	71.11	71.11
Average feed intake/rabbit/kg	5.26	7.60	7.54	7.56	7.47
Cost of feed intake/rabbit (₦)	371.41	540.44	536.17	537.59	531.19
Cost per young rabbit (₦)	800	800	800	800	800
Miscellaneous (₦)	200	200	200	200	200
Total cost of Production (₦)	1371.41	1540.44	1536.17	1537.59	1531.19
Average final weight/rabbit (kg)	1.77	1.53	1.50	1.44	1.45
Sales per mature rabbit (₦)	2000	2000	2000	2000	2000
Profit (₦)	628.59	459.56	463.83	462.41	468.81
Average total weight gain (kg)	1.51	1.19	1.18	1.09	1.08
Feed cost per kg weight gain (₦)	246.19	454.69	454.63	495.35	489.83

Ft= Ficcus thoningii, *Vd = Vitex doniana*, *Do = Daniela oliveri*, *Sl = Sarcocephalus latifolia*,

Conclusion/Applications

1. The experimental forages had good nutrient profiles with low levels of anti-nutritional factors which did not interfere with nutrient absorption by rabbits.
2. Rabbits on concentrate (control diet) performed better than forage based diet in terms of superior daily weight gain, feed conversion ratio, nutrient digestibility and economic analysis.

References

1. Amaefule, K. U., Nwaokoro, C. C. and Iheukwumere, F. C. (2004). The effect of feeding graded levels of raw pigeon pea (*Cajanus cajan*) seed meal in performance nutrient retention and carcass characteristics of weaned rabbits. *Nigerian Journal of Animal production*. 31:194-199.
2. Osinowo, A. O. (1992). Problems and prospect for the development of small ruminant in Nigeria. Proceeding workshop on the Nigerian livestock industry problems and prospect. FDLPCS/ World bank Jos. Pp.26-27.
3. Ranjhnan, S.K. (2001). Animal Nutrition in the tropics. Vikas publishing House. PVT Ltd pp. 31-38
4. Amata, I. A. and Lebari, T. A. (2011). Comparative evaluation of the nutrient profile of four selected browse plants in the tropics, recommended for use as non-conventional livestock feeding materials. *African Journal of Biotechnology 10 (64): 14230-14233.*
5. Akinmutimi, A.H. and Osuagwu, C.C. (2008). Response of Weaner Rabbits Fed Graded Levels of Sweet Potato Meal in Place of Maize-Based Diet. *Pakistan Journal of Nutrition 7 (5): 705-709.*
6. George (2003). The potentials of local vegetables in Nigeria. Hand book on Agriculture 2 (3): 80-86.
7. Chestwort, J. (2002). Ruminant Nutrition Tropical Agriculture. 1st series CTA/Macmillan education London, UK pp120.
8. Cheeke, P. R., (1986). Potential of rabbit production in tropical and subtropical agricultural systems. *Journal of Animal Science* 63: 1581-1586
9. Biobaku, W. O. (1994). Effects of feeding raw and cooked delonix ragia seed bean on the performance of rabbits. *Journal of Agricultural Technology* 7: 10- 14.
10. Nemeat Metrological Agency (2014). Bebi Airstrip, Obanliku, Cross River State
11. Iloeje, N. P. (1991). New Geography of Nigeria, new revised edition. Academic press limited Lagos, pp 23: 44-74.
12. A.O.A.C. (1980). Association of Official Analytical Chemist. 15th Ed. William Tryd Press, Richard Virginia, USA pp1018.
13. Maga, J. A. (1982). Phytete, its chemistry, occurrence, food interaction, Nutritional significant methods of analysis. *Journal of Agriculture food and Chemistry, 30: 1-5*
14. Wheeler, E. L. and Ferrei, R. E. (1971). A method for phytate acid determination in wheat and wheat fractions. Cereal chemistry, 48:312-320

15. Oduguwa, O.O., Oduguwa, B.O., Onwuka, C.F. I. and Olijobi, H.O. (1998). Anti-nutritional factors in foliage of some leguminous trees and shrubs. Proceedings of the silver Jubilee anniversary conference of the Nigeria Society for Animal Production, Abeokuta, Nigeria. pp. 339 -340.
16. Babayemi, O. J., Demeyer, D. and Fervez, V. (2004). Nutrition Value of quantitative assessment of secondary compounds in seeds of eight tropical browse, shrub and pulse legumes comm. Apply Biological Science Glint University, 69(1):103-110.
17. Makkar, A. O. S. and Goodchild, A. V. (1996). Qualification of tannins, a laboratory manual. International centre for Agricultural Research in the dry areas (ICARDA), Aleppo Syria.
18. Chima, C. E. and Igyor, M. A. (2007). Micronutrient andante-nutritional contents of selected tropical vegetable grown in southeast Nigeria, *Nigeria food Journal* 25(1):111-116
19. Bohm, A. B. and Kocipai, A. A. (1994). Flavonoids and condensed Tannis from leaves of Hawaiian *Vaccinium vaticulation and V. calycinnium*, Pacific Science, 48:458-453.
20. Harbone, Z. B. (1973). Phytochemical methods a guide to modern techniques of plant analysis. Chapman and Hall, London. pp. 113-185
21. Lang, J. (1981a). The nutrition of commercial rabbits. Part 1: Physiology, Digestibility and nutrient requirements. Nutritional Abstract and Review series B. 51: 197-227.
22. MINITAB Statistical Software (2014). V.16, Minitab Inc. P.A., US
23. Cheeke, P.R. and Shull, L. R. (1984). Natural Toxicants in feeds and livestock. AVI publishing Incoporated, West port, Connecticut
24. Shane G. (2012). Composition of some Livestock Feeds. University of Arkansas Cooperative Extension Service Printing Services.
25. anzenga, U. (1985). Feeding parent-stock. Zootecnia International, December 1985, pp.: 22-24
26. Mbomi, S.E., Ogungbesan, A.M., Babayemi, O.J., Nchinda, N.P. (2011). Chemical composition, acceptability of three Tephrosia species and use of Tephrosia purprerea as supplement for grazing animals in the western highlands of Cameroon. *Journal of Environmental Issues and Agriculture in Developing Countries.3(3):132-138*
27. Ologhobo A. (1989). Mineral and anti-nutritional contents of forage and legumes consumed by goats in Nigeria. In: RT Wilson, A Melaku (Eds). Proceedings of a Conference on African Small Ruminant Research and Development, Bamenda, Cameroon
28. Okoli, I. C., Maureen, O., Anunobi, O., Obua, B. E. and Enemuo, V. (2003). Studies on selected browses of south-eastern Nigeria with particular reference to their proximate and some internal anti-nutritional constituents. Livestock Res. Rural Dev. 15 (9): 3-7.
29. Fadiyimu, A. A., Fajemisin, A. N. and Alokan, J. A. (2011). Chemical composition of selected browse plants and their acceptability by West African Dwarf sheep. Livestock

Research for Rural Development. Volume 23, Article #256. Retrieved August 13, 2016, from http://www.lrrd.org/lrrd23/12/fadi23256.htm

30. Acamovic, T., Steward, C. S. and Pennycott, T. W. (eds) (2004). Poisons plants and related toxins. Oxford University Press, 608pp
31. Teferedegne, B. (2000). New perspectives on the use of tropical plants to improve ruminant nutrition. Production Nutrition Society, 59: 209-214.
32. Cheeke, P. R. (1971). Nutritional and Physiological implication Saponins: A Review. Canadian *J. Ani. Sci. 51: 621-623*
33. Belmar, R., Nava-Montero, R., Sandoval- Castro, C. and Menab, J. M. (1999). Jackbean (canuvalia ensiforms L. DC) in poultry diets: Anti-nutritional factors and detoxification studies. A. Review. Poultry Sci. J. 55 (1) 37-59
34. Sharma, D. D. S. and Chandra, S. S. (2001). The nutritive value and toxicity of OHI (Albizia stipulate Bovin) tree leaves. J. Res. Ludlhiana 6: 388-393.
35. Abdelsanine, R.E. Ranaweera, K.N.P and Mairo, W.E., (1983). The influence of fibre contents and physical texture of the diet on the performance of broilers in the tropics, Brit. Poult. Sci. 24: 383-389.
36. Aduku, A. O., Dim, N. I. and Aganga, A. A. (1988). Note on a comparative evaluation of palm kernel meal, peanut meal and sunflower meal in diets for weanling rabbits. *J. Appl. Rabbit Res*., 11 (4): 264-266
37. Asar, M. A., Mona, O. H., Yakout, M and Safoat, A. (2010). Utilization of corn-cob meal and faba bean straw in growing rabbit's diets and their effects on performance, digestibility and economic efficiency. Egypt. Poult. Sci. 30: 415-442.
38. Nworgu, F.C. and Ogbosuka, G.E. (2003). Ripe plantain (*Musa paradisiaca*) peels meal as an alternative energy source for weaned rabbits. 28th Ann. Conf. Nig. Soc. Anim. Institute of Agric. Res. Training, O.A.U. Ibadan. Ed(s).
39. Eleraky, W. A., (1996). Utilization of some untraditional feedstuffs in nutrition of rabbits. *Egyptian J. Rabbit Sci., 6 (2): 109-119*
40. Genedy, G. K., Radwan, M. S. M., Abo, A. E., and Zanaty, G. A. (2000). Feeding rabbits dried watermelon by-product (Citrullus Lanatus Var.) as a replacing feed for clover hay. 8th Agricultural Development Research Conference, November, 20 – 22, Faculty of Agriculture, Ain Shams University, Egypt
41. Falcão-e-Cunha, L., Peres, H., Freire, J. P. B. and CastroSolla, L. (2004). Effects of Alfalfa hay, wheat bran or beet pulp, with or without sunflower oil, on caecal fermentation and on digestibility in the rabbit. Anim. Feed Sci. and Technol., 117: 131 – 149.
42. Sarhan, M.A. (2005), Utilization of agro industrial by-product of pea (*Pisum sativum*) in growing rabbit diets. *Egypt J. Rabbit Sci.* 15 (2) 157-172.
43. Omole, T.A., Ajasin, F.O., Obi, Oiuokun, J. A. and Owosibo, A.O. (2003). The effect of partial or total replacement of maize with plantain

peel on performance characteristics and cost advantage of weaned rabbits. 28th Ann. Conf. Nig. Soc. Anim. Prod. Institute of Agricultural Research and Training, O.A.U. Ibadan Ed(s)

44. Cheeke, P.R (1987). Rabbit feeding and nutrition. Academic press, San Diego. Pp. 451-459
45. Al-Shanti, H. A. and Abo Omar, J. M. (2003). Effect of olive cake on layers' performance and egg quality. *J. Al-Azhar University, Gaza (Natural sciences),* 6 (1)
46. Patridge, G.G, Fuller, M.F and Fuller, J.D. (1983). Energy and Nutrient metabolism in lactating rabbits. *British. Journal of Nutrition.* 49. 507-561.
47. Beyen, A.C. (1988). Dietary fat level and growth performance by rabbits, *Journal of Apply Rabbit Research*. 11: 21-29.
48. Hon, M.F., Anugwa, F.O.I. and Oluremi I.O.A. (2007). The effect of dried sweets orange (*Citrus sinensis*) fruit pulp meal on the growth performance of rabbits. *Pakistan Journal of Nutrition 8(8):* 1150-1155
49. Oluremi, O.I.A., Igyu, A.D. and Abu, F.T. (2005). Response of growing rabbits to dietary replacement of maize with sweet orange (*Citruse sinensis*) rind. Production Agriculture and Technology 1(1): 130-136
50. Alawa, J.P and Umunna, N.N. (1993). Alternative Feed Formulation in the developing counties: Prospects for utilization of Agro-Industrial by Products. *Journal of Animal Production Research,*13 (2): 63-98