GROWTH PERFORMANCE OF RABBIT *(ORICTOLAGUS CUNICULUS)* FED LEGUME *(STYLOSANTHES GUINENSIS),* GRASS *(BRACHIARIA DECUMBENS)* AND THEIR COMBINATION

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Abstract

Sixteen mongrel weaner–rabbits averagely six weeks, of mixed sexes were used to assess their performance when fed legume singly and in combination with grass. The animals were allotted into four dietary treatments with two replicates containing two rabbits each in a completely randomized design (CRD) which lasted for seven weeks. The forage materials used were *Stylosanthes guinensis* (legume) and *Brachiaria decumbens* (grass). 100g of concentrate and 200g of test forages were given per rabbit in treatments 2 – 4.The animals in treatment one (the control group) was fed with100g of concentrates and 200g of lettuce and spinach forages. The animals in treatment two were given legume; treatment three was given grass while treatment 4 was given the two forages at a 50:50 combination. The experiment took place at the rabbitry section, Federal College of Animal Health and Production Technology (FCAH&PT), National Veterinary Research Institute (NVRI), Vom, Nigeria. There was no significant difference observed across the treatment groups in final weight and weight gain. The concentrate, forage, total feed intake (TFI) and Feed Conversion Ratio (FCR) were observed to be significantly ($P<0.05$) different across the treatments. Mortality was observed to be higher in treatment 3. The anti-nutritional properties found in legume and grass is: tannins, saponin, oxalate, cyanide and nitrate. It can be concluded that legume/grass could be fed to rabbits with concentrate as supplemental diet (T4) without any deleterious effect on their performance.

Keywords: Rabbit, legume, grass, Anti-nutritional factors, forage, concentrate

Introduction

The need for a shift of concentration to the production of mini livestock cannot be over emphasized, considering the present situation of protein consumption especially in developing countries. Nigeria`s growing population has indicated the need to increase livestock production to satisfy her protein requirement (Ahamaefule *et al*., 2008). Animal Scientists are on a daily basis scouting for alternatives in livestock feeds that are less competitive to humans and industries. Iyeghe-Erakpotobor *et al*., (2006) reported that feeding cost of livestock accounts for a large amount of the total cost of production of animals. The poor conditions in many tropical countries and associated increase in the shortage of animal protein has turned attention to rabbit production as a ready solution to the problem.

Rabbits have several advantages such as short generation interval, small body size (thus low

daily feed requirement), high productive potential, rapid growth rate and ability to utilize forages and fibrous agricultural by-products (Amaefule and Obioha, 1998). FAO, (1996) stated that small scale rabbit production is gaining international attention day by day as a means of alleviating poverty. Rabbit could utilize forage unlike poultry, since they are pseudo-ruminants and they can be maintained on green leaves alone without supplementation of concentrates. However, for the best growth to be achieved by rabbits, forage has to be supplemented with concentrate feed (Omole *et al*., 2007). Inspite of these apparent advantages, rabbit production has not yet achieved its full potentials in the tropics due to inadequate nutrition (Agbede, 2004). Iyeghe-Erakpotobor and Mohammed, (2008) reported that the use of forages in rabbit feeding is a normal practice and rabbit producers are advised to feed forages as a supplement to basic concentrate diet in order to meet their fibre and some of the vitamin requirements. High demand for animal protein and scarcity of resources has necessitated more research on livestock with short generation interval (Abdulrashid and Juniper, 2016). According to Cheeke (1986) intensive approach to rabbit production would however entail the use of alternative plant protein sources other than the conventional ones to enable farmer produce meat at an affordable price. Such alternative sources currently under investigation in Nigeria are being evaluated for nutritive values, availability, acceptability and affordability.

Legumes are superior to other forages (grasses and forbs) in their protein values, mineral and vitamin contents. They are excellent sources of calcium (Ca), potassium (K) and phosphorus (P). Interestingly, a negative characteristic of legume is that some cause bloat in cattle and sheep but such bloat does not occur in rabbit. Grasses tend to be of lower nutritional value to livestock than legume forages as they are usually lower in crude protein (CP), vitamin and minerals (Cheeke, 1987). This study was therefore, aimed at assessing the performance of rabbits fed legume *(Stylosanthes guinensis)* and grass *(Brachiaria decumbens)* as single source and in combination.

Materials and methods

Experimental site

The experiment was carried out at the rabbitry section located in the veterinary clinic of the FCAH&PT, NVRI, Vom. Nigeria. Vom is located in the Guinea Savannah zone of Nigeria, with geographical location on longitude 8º 45` E and latitude 9º 44` N on an altitude of 4200 feet (1280m) above sea level. Relative humidity ranges from 22% in January to 78% July/August. The daily average environmental temperature ranges between 17ºC - 28.6ºC with mean monthly sunshine hours range of 177-288.30 (NVRI, 2018).

Harvest of test ingredients

The legume and the grass used for this experiment were harvested and collected from the pasture section of Dagwom farm, NVRI, Vom, where they are planted for feeding livestock. The legume was harvested before podding and the grass before flowering, at this stage they have not formed too much lignin beyond what the rabbits can tolerate and digest effectively.

Processing of test ingredient

The harvested forages were allowed to wilt overnight under room temperature to reduce the excess moisture before being fed to the rabbits.

Experimental diets

All the dietary treatments were fed with concentrate of 19%CP. Animals in treatment 1 were given 100g of concentrate with lettuce and spinach being the control. Treatment 2 was given 100g of concentrate and 200g of legume, treatment 3 was given 100g of concentrate and 200g of grass, and treatment 4 was given 100g

of concentrate and 50:50 quantity of legume/grass combination per rabbit respectively. The forages were thoroughly mixed in a small earthen pot before being fed to the rabbits so as to reduce the possibility of selection. Water was supplied *ad libitum*. All the forages fed in single or combinations were given in a small earthen pot to reduce unnecessary wastage and to slow down wilting. From treatment 1 - 4 the concentrate fed to them was a supplemental diet containing both energy and over 18% protein.

Experimental house, Design and Management of Rabbits

The rabbits were housed in wooden and metal cages covered with wire mesh in a group of two. The cages were placed in a completely walled and roofed house with open windows. Sixteen (16) crossbred rabbits of different sexes aged between 5-6 weeks were purchased from local farmers in Vom for this study. The rabbits were randomly allotted to the four (4) diets with each diet having two replicates containing 2 rabbits each in a completely randomize design (CRD). The experiment lasted for 7 weeks (49 days).

Laboratory Analysis

Determination of Anti-nutritional factors

The anti-nutritional factors determinations were carried out at the Biochemistry Department, National Veterinary Research Institute (NVRI), Vom and were as follows: The method of estimation of tannins content of legume and grass was according to the standard method as described by (Josely, 1970); (Lohan *et al*., 1980); (Santram *et al*., 1981); (Negi, 1980). Saponin was determined by the method according to (Harbone, 1973). The oxalate content of legume and grass was determined using the method as described by (AOAC, 1990). Cyanide content of legume and grass was determined using the method as described by (Onwuka, 2005). Nitrate was determined according to the method as described by (Rodier, 1975).

Statistical Analysis

All data obtained were subjected to analysis of variance (ANOVA), SPSS (2006), statistical difference between means were separated using Duncan Multiply Range Test (Duncan, 1955).

Results and Discussion

Table 1 contains the ingredient composition of the supplemental feed given to the rabbits; the feed contains a CP of 18.7 and a metabolisable energy of 2454 Kcal/kg which is enough to provide the rabbits with the nutrients needed for their growth. The results presented in Table 2 shows that the final weight in all the dietary groups were not significantly ($P>0.05$) different hoever, the control and legume/grass treatments recorded the highest weight (1200g) and the rabbit fed grass recorded the least weight (1000g).The deference could be due to the fact that the concentrate and forage fed to the control group may be a more balanced diet and the legume/grass seemed to be more palatable and complementary compared with grass. Average daily weight gain (7g-11g) is within the same range (5g-10g) as reported by (Iyeghe-Erakpotobor *et al*., 2006). Total feed intake across the dietary treatments were significantly ($P<0.05$) different. Rabbits fed legume recorded a high feed intake of 1540g compared to the other dietary groups which recorded lower feed intake. The animals in the control group that were fed concentrate and other vegetables had the least feed intake (1130g). Probably because animals eat to satisfy their energy requirements and that feed intake is primarily based on the amount of energy in the diets (Smith, 2001). The high feed intake in the legume group could probably be due to the legume that was more succulent and palatable than the grass or their combination. This result is contrary to the findings of Agbede, (2004) who stated that animals fed

grasses had higher feed intake compared to animals fed legumes due to higher anti-nutritional factors (tannins) in legume.

Feed intake of both the concentrate and the forages were significantly (P<0.05) different and showed decrease across the dietary treatments. Rabbits fed treatment 2 (legume) recorded the highest (1540g) total feed intake. This result concur with the findings of Iyeghe-Erakpotobor *et al*., (2006)) who observed a significant decrease in TFI of rabbits fed concentrate and forages which they attributed to the high crude fiber (CF) content of all the forages. This is in conformity with the findings of Hassanat *et al*., (2006) who reported that tropical forages were unsuitable as sole feed for rabbits due to the low digestibility below 10%. The rabbits fed grass had the highest mortality probably because grasses contain high CF which can depress feed intake in non-ruminants. Cheeke (1992) stated that most tropical grasses despite their deceptive lush and succulent appearance are highly indigestible and should not be considered as suitable forages for rabbit's production.

The FCR was significantly (P<0.05) lower in the control than the other dietary treatments, this may be due to the cost of feed fed to the animals. The high mortality experienced during the study may be attributed to coccidiosis infection since the experiment was carried out during rainy season which made the environment to be damp. Some of the symptoms noticed because of the coccidiosis infection were bloody diarrhea, anorexia, presence of blood in their faeces and retarded growth among others (Halla, 2005).

Table 3 shows anti-nutritional factors in the forages used; tannins, saponin, oxalate, cyanide and nitrate were present in the forages. From the result obtained it can be observed that the quantity of tannins (1.06mg/100g than in grass 0.88mg/100g), saponin (0.74 mg/100g than in grass 0.6 mg/100g), cyanide (0.42 mg/100g than in grass 0.28 mg/100g) and nitrate (1.44 mg/100g than in grass 0.62 mg/100g). However, it was observed that the quantity of oxalate in grass (2.04mg/100g) was more than that of legume (1.22mg/100g).

Most monogastric animals including rats/mice have been shown to secrete proline-rich proteins in their saliva which constitute the first line of defense against ingested tannins. Deleterious effects and episode of toxicity suggest inadequacy of defense against high quantity of dietary tannins (Kumar, 1983).Tannins causes decrease feed consumption in animals; bind dietary protein and digestive enzymes to form complexes that are not readily digestible (Aletor, 1993). They also cause decrease palatability and reduce growth rate (Roeder, 1995). Several studies indicate that tannin-rich leaves, in combination with concentrate rations could be fed to animals without any adverse effects. This happens because animals consume protein in excess of their requirement from the concentrate and therefore, the anti-nutritional effects of tannins were masked (Raghavan, 1990). Saponin was observed to be high in legume (0.74mg/100g) than grass (0.46mg/100g). Non ruminants are more prone to anti-nutritive effects of saponin which include retardation of growth rate, due primarily to reduction in feed intake (Cheeke and Shull, 1985). It causes hypocholesterolaemia by binding cholesterol making it unavailable for absorption. They also cause haemolysis of red blood cells and are toxic to rats (Johnson *et al*., 1986). Saponin is usually associated with bitterness; this bitterness can be reduced by repeated washing of the forage to make it more palatable to the animals (Joshi *et al*., 1989). Oxalate which is an anti-nutritional component of plant, if consumed in large quantities is associated with blockage of renal tubules by calcium oxalate crystals and development of urinary calculi (Blood and Radostits, 1989). Oxalate like phytates bind minerals like calcium and

magnesium and interfere with their metabolism.

Cyanide ions inhibit several enzyme systems, depress growth rate through interference with certain essential amino acids and utilization of associated nutrients. They also cause acute toxicity, neuropathy and death (Fernando, 1987). The presence of more nitrates in the legume may suggest that most plants contain anti-nutritional factors which probably serve as defensive mechanism against predators. It may also probably be a way of storing nutrients or a means of defending their structure and reproductive elements (Harbone, 1989). Nitrates are present in all plants and are essential source of nitrogen for normal growth (Okafor, and Nwogbo, 2005). Factors that determine the nutritive value of foods and feedstuffs are very complex. Too much emphasis is usually put on the analysis of CP and CF as indicators of feed value. More importance should be given to the presence of secondary plant compounds such as tannins and hydrolysable phenolics, which may interfere with the level of CP and CF contents, which are used as indicators of high nutritional value (Soetan, 2009).

Conclusion

From this study, it can be concluded that rabbit could be fed with *Stylosanthes guinensis* (legume) with concentrate containing both energy and over 18% protein as supplemental diet to obtain a maximum growth performance devoid of health challenges. It was observed that the presence of anti-nutritional factors in legume may not have had effect on the growth of rabbit when legume was utilized as forage feed. This should encourage farmers to engage in rabbit keeping which will help to boost the production and availability of protein to the common man at a cheaper rate and without any deleterious effects.

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Table 1: Ingredient composition of supplementary diets fed to Rabbits

Ingredients	**Composition (%)**
Maize	44.56
Groundnut cake	22.70
Wheat offal	29.70
Limestone	1.00
Bonemeal	1.52
Salt	0.25
Premix	0.25
Total	**100**
Calculated analysis	
CP (%)	18.70
ME Kcal/Kg	2454
Ether extract	3.86
CF (%)	5.61
Ca (%)	0.85
Avail. P (%)	0.39
Lysine (%)	0.58
Methionine (%)	0.24

Biomix grower premix supplied per kg- Vit A 8,000 IU; Vit D_3 1,500 IU; Vit E 700mg; Vit K_3 1,500mg; Vit B_1 2,000mg; Vit B_2 5,500mg; Niacin 15,000mg; Pantothenic acid 5,500mg; Vit B_6 2000mg; Vit B_{12} 10mg; Folic acid 500mg; Biotin H_2 250; Choline chloride 175mg; Cobalt 200mg; Copper 8,000mg; Iodine 1,000mg; Iron 21,000mg; Manganese 40,000mg; Selenium 200mg; Zinc 31,000mg; Antioxidant 1,250mg

Table 2: Performance characteristics of Rabbits fed concentrate, grass and in combination

Parameters	**Control**	**Legume**	**Grass**	**Legume/Grass**	**LOS**
Initial Wt (g)	600.00	580.00	570.00	605.00	NS
Final Wt (g)	1200.00	1100.00	1000.00	1200.00	NS
Av. DWG (g)	11.00	10.00	07.00	09.00	NS
TFI (g)	1130.00^{b}	1540^{a}	1380^{ab}	1410^{a}	*
FCR	2.05^{b}	2.80^{a}	2.91^{a}	2.56^{a}	*
Conc I(g)	680.00^{a}	470.00^{b}	360.00^{b}	370.00^{b}	*
Forage (g)	450.00^{b}	1070.00^{a}	1020.00^{a}	1040.00^{a}	*
Mortality (%)	50.00^{b}	75.00^{a}	50.00^{b}	50.00^{b}	*

a,b, means in the same row having different superscripts are significantly different (P>0.05)
NS- Not Significant, Wt- Weight, DWG- Daily Weight Gain, Conc I- Concentrate Intake,
TFI- Total Feed Intake and FCR- Feed Conversion Ratio

Table 3: Anti-nutritional properties in forages used (mg/100)

Anti-nutritional propertiies	Legume	Grass
Tannins	1.06	0.88
Saponin	0.74	0.46
Oxalate	1.22	2.04
Cyanide	0.42	0.28
Nitrate	1.44	0.62