Exploitation of unconventional protein sources in the feed of weaner rabbits (*Oryctolagus cuniculus* Linn.)

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Abstract

An experiment was conducted to explore the use of some leguminous shrubs, commonly accepted as protein sources for feeding ruminants but rarely considered as feed for micro livestock animals such as rabbits. Thirty two weaner rabbits of heterogeneous population, aged 4 weeks and balanced for sex, were randomly allotted to four experimental diets, in a completely randomized design, containing *Moringa oleifera*, *Leucaena leucocephala* and *Gliricidia sepium*, with *Centrosema pubescens* serving as control. Total feed on offer was done at 4% body weight with concentrate supplementation at 25% of the total feed while forages were fed fresh. Results indicated that the crude protein content of the forages ranged from 21.64 g/100g DM to 26.88 g/100g DM in *Centrosema pubescens* and *Moringa oleifera*, respectively. Similarly, the crude fibre contents of the forage ranged from 14.47 g/100g DM to 21.89 g/100g DM *Centrosema pubescens* and *Moringa oleifera*, respectively. Although rabbits on *Centrosema pubescens* had the least weight ($P < 0.05$) throughout the experiment, yet they recorded the highest total feed intake ($P < 0.05$) of 6.348 kg, while the least feed intake was recorded for rabbits on *Gliricidia sepium* (5.48 kg). Rabbits on *Moringa oleifera* and *Leucaena leucocephala* gave the best ($P < 0.05$) daily weight gain of 10.52 and 10.38g/d respectively, followed by those on *Gliricidia sepium* (10.05g/d) and least for rabbits on *Centrosema pubescens* (9.90g/d). The feed conversion ratios of rabbits on the forages were similar ($P > 0.05$) except for rabbits on *Centrosema pubescens* ($P > 0.05$). Nitrogen intakes of the rabbits from the different forage sources were similar ($P > 0.05$) but the nitrogen utilization differed significantly ($P < 0.05$) with rabbits on *Leucaena leucocephala* recording the highest value (78.52%), closely followed by rabbits on *Moringa oleifera* (76.46%) but the nitrogen utilization of rabbits on *Gliricidia sepium* and *Centrosema pubescens* are similar (66.23% and 66.11%, respectively). It can therefore be concluded that the unconventional forage shrubs hold potential as alternative feed sources for grower rabbits and *Moringa oleifera* and *Leucaena leucocephala* can conveniently replace *Centrosema pubescens* in the feeding of rabbits especially where the latter is depleted in stock.

Key words: Forages, Leguminous shrubs, Micro livestock, Nitrogen utilization

Introduction

Low supply and high cost of animal proteins such as beef, pork, mutton, chevon, poultry, egg and milk has brought about an acute shortage of animal protein in the diet of most Nigerians. This is mainly due to the high cost of conventional feed ingredients used in formulating rations for livestock. Rabbit meat is thought to be capable of

bridging the gap of inadequate animal protein in Nigerian diets since it has shown tremendous potential in many developing countries as a means of supplying cheap, high quality animal protein within the shortest possible time using diets based mainly on forages (Hassan *et al.*, 2012).

The problem of inadequate feed as a result of strong competition between man and

livestock for these important feed ingredients, such as maize and groundnut cake (GNC), has been a major threat to rabbit production particularly in the tropics. To mitigate the problem of feed availability in the tropics for rabbit production, use of browse plants, shrubs and legumes is regarded as good option. The nutrition of rabbit in Nigeria is primarily based on *Tridax procumbens* and/ or *Centrosema pubescens* whose growth and availability in the dry season cannot sustain all year-round rabbit production (Odeyinka *et al.*, 2007). Browse plants can endure the dry season better and are found to be available throughout the year. Most browse plants, shrubs and legumes have high crude protein content, ranging from 10 to more than 25% on dry matter basis (Haile and Tolemariam, 2008); they may be considered as a more reliable feed resource of high quality suitable to develop sustainable feeding systems and for increasing livestock productivity (Okoli *et al.*, 2003).

Several of these forages exist in Nigeria, but their full utilization by growing rabbits has not been well documented. Moringa species are legume shrubs whose exploitation has just begun for livestock production in the tropics (Ewuola *et al.*, 2012). Moringa is reported to be a multipurpose shrubs/trees, it is a fast growing tree which can reach 12m in height at maturity, yielding up to 1020 tonnes/ha/yr when planted very densely for use as forage (Makkar and Becker, 1997). It is reported to contain crude protein as high as 27 % (Makkar and Becker, 1997). Chisowa and Mwenya (2013) had earlier reported that *Gliricidia sepium* and *Leucaena leucocephala* were adequate forage feeds for rabbits in Zambia.

Indigenous multipurpose browse species are well known to farmers and are better adapted to the environments than exotic

ones. Consequently, they are in common use in many parts of the country though not on scientific basis. They are also important feed resources in traditional animal agro-forestry systems throughout the tropics but their potential as forage has been a subject of little research. This study was therefore designed to compare the Nitrogen utilization and feeding quality of unconventional indigenous forages as basal feed for weaned rabbits (*Oryctolagus cuniculus*) in Nigeria.

Materials and Methods

Experimental Site

The study was carried out at the Rabbit Unit of the Teaching and Research farms of Obafemi Awolowo University (OAU), Ile-Ife, Osun state, Nigeria (7°31'N, 4°31'E).

Test Materials and Diets

Fresh, young leaves of *Centrosema pubescens* (Centro) were harvested from established plots at the Teaching and Research farms, OAU, while leaves of *Moringa oleifera* (Moringa), *Leucaena leucocephala* (Leucaena), *Gliricidia sepium* (Gliricidia) were harvested from the top of the branch to the end of the soft stem part considered as potential feed. Ingredients for concentrate feed were sourced for and compounded at the feed mill of the Teaching and Research farms, OAU, Ile-Ife.

A common concentrate diet was compounded as a supplement at 25% level of inclusion to the forage shrubs on offer. Total feed supply was done at 4% body weight of the rabbits. The concentrate was moistened with water to reduce dustiness and consequent effect on respiratory distress in the animals.

Experimental Animals and their Management

Thirty two (32) weaner rabbits of heterogeneous population were used for

this experiment. Animals were about 4 weeks old, weighing between 350-500g. After balancing for sex, the animals were randomly allotted to four dietary forages as treatments namely, *Centrosema pubescens* (Centro), *Moringa oleifera* (Moringa), *Leucaena leucocephala* (Leucaena) and *Gliricidia sepium* (Gliricidia). Rabbits were housed two per hutch and each animal was weighed before the commencement of the experiment and subsequently on weekly basis after every week to determine weight changes. Growth and digestibility trial lasted for 12 weeks. Feed and leftovers were weighed to estimate intake and refusals, respectively. For the purpose of digestibility study, the cages were fitted with mechanism and apparatus for daily quantitative removal and collection of urine and fecal samples.

During digestibility trials, urine and faecal samples were collected daily. Samples of faeces collected were stored at -20 °C in a deep freezer immediately after collection. At the end of each collection period, the samples were bulked for each animal, for proximate analysis according to AOAC (1990) procedures. Nutrient components of the concentrate; Moringa, Leucaena, Gliricidia and Centro were also determined according to AOAC (1990). Parameters measured were growth performance, digestibility and nitrogen utilization. Volatilization of nitrogen from urine was prevented by introducing 0.1N of HCl into the urine container.

Statistical analysis

Data obtained were statistically analyzed using the general linear model of SAS (1998) and means were separated using Duncan multiple range tests as contained in the same statistical package.

Results and discussion

Table 1 shows the chemical composition of

the concentrate diet while Table 2 shows the chemical composition of the forage shrubs fed to the rabbits. The nutrient profile of the forages showed that the forages have enough qualities to meet the nutritional need of the rabbits. The range of dry matter (DM) values of all forages used in this study was higher (35-57%) than 25.21-30.31% reported by Nweze (2005) for some grasses and legumes. The range of crude protein values obtained for the forages (21.64 – 26.88 %) were within the range of 23.5 and 20.9 % CP reported for Moringa and Centro respectively (Odeyinka *et al.*, 2008) and 22.03 and 19.98% CP for Calopo and Centro respectively (Aderinola *et al.*, 2008) Nweze (2005) reported higher crude protein of 24.12% for Centro fed to young rabbits. Aliyu (1990) reported that 16 - 18% crude protein (CP) level in forages was adequate for growth and reproduction in rabbits. This suggests that forages used in this study were adequate to meet the CP requirements of the rabbits since they all have CP values above this requirement. Crude fibre (CF) of 12.33 - 21.89 % obtained for forages in this study were higher than those reported for Pawpaw, plantain and Centro (5.82-7.30%) by Akpan *et al.* (2006). Cheeke *et al.* (1982) had earlier recommended crude fibre level of 10-12% in rabbit diets. The results in this study indicated that crude fibre values were adequate and similar to the recommended values. Ether extracts values (19.49-34.90 %) for all the forages were higher than 2.42% reported for Centro by Nweze (2005). These results indicated that based on their chemical composition, all forages evaluated were adequate as feed for rabbit production.

Growth performance of rabbits fed the different forages is shown in Table 3. Total feed intake differed significantly ($P < 0.05$) across the forages with rabbits on Centro

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Table 1: Gross composition of the concentrate diet offered to the weaner rabbits

Ingredients	Composition (%)
Groundnut cake (GNC)	8.00
Wheat offal	19.00
Palm kernel cake (PKC)	50.00
Maize	15.00
Fish	5.00
Bone meal	2.00
Lysine	0.25
Methionine	0.25
Salt (NaCl)	0.25
Min./Vitamin premix ^a	0.25
Total	100

^a Premix supplied per type kg diet: Vit. A, 100,00 IU; Vit. D 2,000,000 IU; Vit. E, 23,00mg; Vit K3 2,000mg; Vit. B, 3,000 mg; Vit. B2, 6,000 mg; Niacin, 50,00 mg; Calcium. 800 mg; Panthotenate, 10,000 mg; Vit. B6, 5,000 mg; Vit B12, 250 mg; Folic acid, 100 mg; Biotin, 50 mg; choline chloride, 40,000 mg; Selenium, 120 mg and Anti oxidant, 12,000 mg

Table 2: Chemical composition (%) of experimental diets (forages)

Parameter	<i>Centrosema pubescens</i>	<i>Moringa Oleifera</i>	<i>Leucaena leucocephala</i>	<i>Gliricidia sepium</i>
Dry Matter	57.00	38.00	36.00	35.00
Crude Protein	21.64	26.88	26.17	24.58
Crude Fibre	14.47	21.89	12.33	14.57
Ether Extracts	19.49	28.83	34.90	27.50
Ash	6.69	5.60	6.05	5.72
Nitrogen-free extractives/extracts	37.71	16.80	20.55	37.71

Table 3: Growth Performance of weaner rabbits fed unconventional forage sources.

Parameters (g)	<i>Centrosema pubescens</i>	<i>Moringa Oleifera</i>	<i>Leucaena leucocephala</i>	<i>Gliricidia sepium</i>	SEM
Initial weight	488.57 ^d	617.14 ^a	524.29 ^b	500.00 ^c	15.25
Final weight	1320.17 ^d	1500.82 ^a	1396.21 ^b	1344.20 ^c	21.00
Total feed intake	6348.00 ^a	5779.00 ^c	5789.00 ^b	5480.00 ^d	94.59
Average daily intake	75.57 ^a	68.80 ^b	68.92 ^b	65.24 ^c	1.16
Total weight gain	831.60 ^d	883.68 ^a	871.92 ^b	844.20 ^c	6.49
Average daily gain	9.90 ^c	10.52 ^a	10.38 ^a	10.05 ^b	0.08
Feed conversion ratio	7.63 ^a	6.54 ^b	6.64 ^b	6.49 ^b	0.14

^{a,b,c} : Means within rows with different superscript are significantly different (P<0.05).

Table 4: Nitrogen utilization of rabbits fed unconventional forage sources

Parameters (g/day)	<i>Centrosema pubescens</i>	<i>Moringa Oleifera</i>	<i>Leucaena leucocephala</i>	<i>Gliricidia sepium</i>	SEM
Nitrogen Intake	7.23	8.07	7.96	7.70	0.02
Faecal Nitrogen	2.18 ^a	1.24 ^b	1.44 ^b	2.20 ^a	1.04
Urine Nitrogen	0.27	0.66	0.27	0.40	0.05
Nitrogen balance	4.78	6.17	6.25	5.10	0.03
Nitrogen utilization (%)	66.11 ^c	76.46 ^b	78.52 ^a	66.23 ^c	1.73

^{a,b,c} : Means within rows with different superscript are significantly different (P<0.05).

recording the highest total intake of 6.348 kg on dry matter basis, while the least was observed for rabbits on *Gliricidia* forage (5.48 kg). The higher feed intake recorded for rabbits on *Centro* might be because they are used to the forage as their basic forage source which makes it readily acceptable, while the low intake observed in rabbits fed *Gliricidia* may be linked to the astringent nature of the forage which could reduce its acceptability. According to Lowry (1990), the only real constraint to the feed value of *Gliricidia* lies in its palatability. Grazing animals seem to refuse *Gliricidia* leaves on the basis of its smell, often rejecting the leaves without tasting it, which suggests that the problem lies with volatile compounds (coumarin) released from the leaf surface (Bosman *et al.*, 1995).

Average daily weight gain of the rabbits was least ($P < 0.05$) for those on *Centro* forage (9.90 g/d) and highest in rabbits on *Moringa* although the difference in the rate of gain between the rabbits on *Moringa* and *Leucaena* were similar ($P > 0.05$). Notwithstanding the differences in the rabbit's average daily weight gain, the range of 9.90 to 10.38 g/day recorded are in agreement with the report of Iyeghe-Erakpotobor *et al.* (2001) who obtained a rate of gain of 5 -10 g/day for three breeds of rabbits in Northern guinea savannah of Nigeria. The higher daily weight gain observed for rabbits fed *Moringa* may be as a result of the nutritive value of the leaves. *Moringa* have been reported to contain significant quantities of vitamins A, B, and C, Calcium, Iron, Phosphorus and Protein (Makkar and Becker, 1997) and as such, its rich nutrients would have translated to its better utilization by the rabbits, resulting in higher weight gains by the animals. The daily weight gain obtained for rabbits in this study were lower than the range (16.0-45.1g/d) reported by Harris *et al.* (1981)

who fed alfalfa meal and tropical forages to weaned rabbits. Hassan *et al.* (2012) also reported a daily weight gain of 22.2 – 26.3 g/d for rabbits fed pea vines. The feed conversion ratio of rabbits on *Moringa*, *Leucaena* and *Gliricidia* were similar ($P > 0.05$) and better ($P < 0.05$) than that of those fed *Centro* forage. The similar values obtained for the three forages indicated the potential of any of the forages serving as a better replacement to the conventional *Centro* in the feeding of young rabbits.

Table 4 shows and the nitrogen utilization of rabbits fed the unconventional forages. Nitrogen intake was similar ($P > 0.05$) among all the forage diets. This may be due to the similar CP levels of all forages fed to rabbits.

Despite the variation in the faecal nitrogen among rabbits fed the different forages, nitrogen balance was similar ($P > 0.05$) among the animals but rabbits on *Leucaena* recorded the highest ($P < 0.05$) nitrogen utilization (78.52%), closely followed by those on *Moringa* diets (76.46%), indicating the protein of the two forages as being better metabolized in the rabbits.

Conclusion

All the tropical forages have adequate nutritive components to meet the metabolic demands of rabbits, with the added advantage of being able to supply feed in the drought period. It can be concluded from this study that unconventional forage shrubs hold potential as alternative feed for grower/weaned rabbits. *Moringa oleifera* and *Leucaena leucocephala* posses the potential of replacing *Centrosema pubescens* in the feeding of rabbits without any adverse effect on their growth performance.

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