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Nutritional Efficiency of Selected Unconventional Forages in Diets of Weaner Rabbits

***Odedire J.A. and Oloidi F.F**

Department of Animal Sciences, Obafemi Awolowo University, Ile – Ife, Nigeria

****Corresponding Author:*** oadeolu1@gmail.com; Phone no.: +2348038549533

Target audience: Animal Nutritionists, Pasture scientists, Rabbit keepers

Abstract

An experiment was conducted to compare the dietary efficiency of Moringa oleifera and Centrosema pubescens in rabbit nutrition. Twenty four weaner rabbits weighing between 451.25 and 452.50g were allotted to three treatment diets containing Moringa oleifera, Tephrosia candida and Centrosema pubescens in a completely randomized design. The rabbits were fed a combination of forage and concentrate diets in the ratio 1:1. Feeding was done at 5% body weight. Parameters measured include Average daily intake, Average daily weight gain, Crude protein digestibility and Nitrogen utilization. Average daily feed intake of rabbits on M. oleifera (18.32g) and T. candida (17.87g) were similar (P>0.05) and higher (P < 0.05) than rabbits on C. pubescens forage (15. 64g). Crude protein digestibility increased (P < 0.05) from 81.24 g/100g in rabbits fed C. pubescens to 84.71 g/100g in M. oleifera fed rabbits Similar trends were observed for the Nitrogen retention and Total weight gain as the highest (P < 0.05) Nitrogen Retention and Total weight gain were recorded for rabbits on M. oleifera forage (71.60% and 847.50g respectively) followed by those on T. candida (67.80% and 822.50g respectively) and the least (60.39% and 817.50g respectively) for rabbits on C. pubescens forage. It was therefore concluded that Moringa oleifera forage gave the best performance in terms of, nutrient digestibility, nitrogen utilization and total weight gain.

Keywords: *Crude protein digestibility, Forage, Nitrogen retention, Total weight gain.*

Description of Problem

The increasing demand for animal protein necessitates the need to intensify livestock production. In developing countries such as Nigeria, there is insufficient animal protein intake due to low productivity of the livestock as a result of inadequate protein intake in their diets (1). Feed supply has remained a major constraint in animal production due to increasing cost of conventional feedstuffs, occasioned by the competition between man and animal for available sources of protein (2). Rabbit is fast becoming an important source of animal protein with its ability to utilize forages efficiently (3). Rabbits are efficient converters of feed to meat and are capable of utilizing up to 30% crude fibre, which promotes intestinal mobility, as against 10% by most poultry species. (4, 5). Rabbits have a number of characteristics that might be advantageous to smallholder subsistence type integrated farming system (6). As such, the domestic rabbit has been recommended as a good alternative source of dietary protein for the increasing human population in developing countries due to their short – cycled production

characteristics (7, 8). Green plants of various sources have been recognized as the cheapest and most abundant potential source of proteins because of their ability to synthesize amino acids from a wide range of virtually unlimited and readily available primary materials such as water, carbon dioxide, atmospheric nitrogen (9). Example of such green plants are *Moringa oleifera, Centrosema pubescens* and *Tephrosia candida. Moringa oleifera* is a perennial soft wood with timber of low quality (10). It is a promising food source for livestock in the tropics because the tree still remains green towards the end of the dry season when most other forages are scarce (11). *Tephrosia candida*, a shrubby tropical, sub – perennial leguminous plant, has been documented to hold great potentials in ruminant forage nutrition (12, 13) but its use in rabbit nutrition has not been largely investigated, whereas *Centrosema pubescens* has been documented as one of the commonest forages employed in the feeding of domestic rabbits. *Moringa oleifera* has been implicated in previous studies as holding a great potential in rabbit's nutrition than most other contemporary leguminous shrubs (14,15) but the comparative efficiency of the nutritional performance of rabbits fed *Tephrosia candida* and those fed *Moringa oleifera* has not been adequately documented, hence this study.

Materials and Method

Experimental site

The study was carried out at the Rabbit unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile – Ife, Osun State, during the late rains (September and October).

Experimental design and management

The experiment, which lasted 8 weeks, was conducted using a total of twenty four (24) heterogeneous stocks of weaner rabbits with a weight range of 451.25 – 452.50g and of both sexes. The animals were allocated into three treatments of eight replicates per treatment in a completely randomized design. Each animal was weighed before the commencement of the study and subsequently at weekly interval to determine weight changes throughout the period of experiment.

Experimental diets

Twenty four weaner rabbits were allotted a basal concentrate diet and three forage diets: *Centrosema pubescens, Tephrosia candida* and *Moringa oleifera*, with eight rabbits per forage treatment and each rabbit serving as a replicate. Feeding was done at 5% body weight of the animals such that the rabbits were fed forage at 2.5% body weight and concentrate at 2.5% body weight. Fresh clean water was provided to the rabbits *ad libitum*. Forages were hung on the rabbit's individual hutch, with binding wire to prevent contamination.

Data collection

Weight measurements were taken at weekly intervals. Feed leftovers were weighed to determine feed intake. Faeces and urine were collected from the rabbits' hutch, between the seventh and eighth week, using a modified metabolism tray fitted with sieve to separate urine from faeces. Forages, faeces and concentrate feed samples were analysed for proximate contents according to the procedure of AOAC (16) and urine was digested to determine the nitrogen utilization of the rabbits, using the same method.

Statistical Analysis

All data obtained were analyzed using the General Linear Model procedure of SAS (17) and Duncan Multiple Range Test of the same package was used to separate means, where significant.

Results and Discussion

Table 1 shows the proximate composition of the concentrate diet and the forages offered

to the weaner rabbits. The findings imply that the experimental diets were adequate in meeting the requirements of the rabbits (18, 19). The crude protein (CP) contents of *Moringa oleifera* and *Tephrosia candida* are comparably better than that of *Centrosema pubescens.*

The CP values of 25.38 and 22.19% obtained for *Moringa oleifera* and *Tephrosia candida* respectively, in this study are higher than the earlier reported for the two forages (13, 14) while the dry matter and crude protein contents obtained for *Centrosema pubescens* and *Moringa oleifera* are lower to values reported by Odedire and Abegunde (15). The differences in reported values could be attributed to season and the age of the forage shrubs which is dependent on their harvesting frequencies. The reported experiments (13, 14) were carried out at the peak of the raining periods while the current experiment was conducted during the late rains. The high crude fibre (CF) contents of *Centrosema pubescens* (28.47%) and *Tephrosia candida* (23.45%) was compensated for, in the CF of the concentrate diets (3.76%) offered the rabbits while the CF content of *Moringa oleifera* is close to the recommended range of 10 – 12% on dry matter basis (20). The CP value of 19.25% recorded for *Centrosema pubescens* in this study is lower than that reported (20.9%) by Odeyinka *et al*. (14) .The variation may be due to different season of the year, and age of cutting. *Moringa oleifera* was observed to contain a relatively higher Ether extract (7.32%) than *Tephrosia candida* (5.96%) and *Centrosema pubescens* (3.11%). High ether extract contents have been associated with rich sources of carotene and pigments (21), and Makkar and Becker (22) have implied Moringa leaves as being rich in carotene.

Table 2 shows the performance characteristics of the weaner rabbits fed the selected forages. The average daily feed intake for rabbits on *Moringa oleifera* (18.32g/d) and *Tephrosia candida* (17.37g/d) was similar ($P > 0.05$) but higher ($P < 0.05$) than those on *Centrosema pubescens* (15.64g/d). The better intake values recorded for *Moringa oleifera* and *Tephrosia candida* are reflected in their nutrient composition which suggests that nutrient components of a forage may be positively correlated with palatability. Igwebuike *et al*. (23) attributed low feed intake in rabbits to the consumption of fibre diets which was highest in *Centrosema pubescens* in this study. Rabbits on *Moringa oleifera* diet recorded the highest values ($P < 0.05$) for average daily gain (15.13 g/d) and total weight gain (847.50g), followed by those on *Tephrosia candida* forage and least in Rabbits fed *Centrosema pubescens* (14.59 g/d and 817.5g respectively). The average daily weight gain obtained was within the range of reported values (10 – 20g/rabbit/day) observed for most rabbits reared in tropical environment (20). The feed conversion ratio (FCR) observed for rabbits on *Moringa oleifera* and *Tephrosia candida* were similar ($P> 0.05$), indicating a marginal superiority of *Moringa oleifera* over *Tephrosia candida* forage.

The apparent nutrient digestibility of the rabbits fed the selected forages is shown in Table 3. Dry matter, Ether extract and Ash digestibility were highest ($P<0.05$) in rabbits fed *Centrosema pubescens* (62.05, 60.31 and 72.36% respectively), while Crude protein and Crude fibre digestibility were highest ($P<0.05$) in rabbits on *Moringa oleifera* forage (84.71 and 67.75% respectively). The higher values recorded for crude protein and crude fibre digestibility in *Moringa oleifera* based diet confirmed the superiority of the forage over others with *Centrosema pubescens* showing only superiority on the availability of its mineral contents for uptake.

Table 4 shows the Nitrogen utilization of the selected forages by the weaner rabbits. Significant ($P <0.05$) variations exist for all the parameters observed. Nitrogen intake was

highest for rabbits on *Moringa oleifera* forage (3.52 g/d) and least for those on *Centrosema pubescens* forage (3.03 g/d).similar trend was observed for the Nitrogen balance and Nitrogen retention of the rabbits as the highest values were recorded for those on *Moringa oleifera* forage (2.52 g/d and 71.60% respectively) and least for rabbits on *Centrosema pubescens* (1.83 g/d and 60.39% respectively). The superior Nitrogen availability of *Moringa oleifera* was consistent with its crude protein composition, making its utilization better than *Tephrosia candida* and *Centrosema pubescens*.

Conclusions and Applications

1. Both *Moringa oleifera* and *Tephrosia candida* hold the potential of being a suitable forage option in the nutrition of rabbits as they performed better than the conventional *Centrosema pubescens*.
2. *Moringa oleifera* and *Tephrosia candida* could be included in forage of rabbits as they both enhanced the nutritional performance of the growing rabbits.
3. Rabbits on *Moringa oleifera* forage gave the best performance in terms of Feed intake, Nutrient digestibility, Nitrogen utilization and Total weight gain.

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Table 1: Proximate composition of concentrate and selected forages fed to the weaner rabbits

Parameters (%)	Concentrate	*Centrosema pubescens*	*Tephrosia candida*	*Moringa oleifera*
Dry Matter	88.40	23.89	20.16	17.83
Crude Protein	18.59	19.25	22.19	25.38
Crude Fibre	3.76	28.47	23.45	9.03
Ether Extract	2.22	3.11	5.96	7.32
Ash	7.41	7.77	6.11	8.51
NFE	68.02	41.4	41.29	49.76

NFE = Nitrogen free extractives

Table 2: Performance characteristics of rabbits fed the selected forages

Parameters	*Centrosema pubescens*	*Tephrosia candida*	*Moringa oleifera*	SEM
Total feed intake(g)	875.94^{b}	1000.54^{a}	1025.66^{a}	46.32
ADFI (g/day)	15.64^{b}	17.87^{a}	18.32^{a}	0.83
Initial weight (g)	451.25^{a}	452.50^{a}	452.50^{a}	0.42
Final weight (g)	1268.75^{b}	1275.00^{b}	1300.00^{a}	9.55
Total weight gain (g)	817.50^{c}	822.50^{b}	847.50^{a}	9.28
ADG (g/day)	14.59^{c}	14.69^{b}	15.13^{a}	0.22
FCR	1.07^{b}	1.22^{a}	1.21^{a}	0.02

^{a,b,c} means on the same row with different superscripts are significantly different ($P<0.05$)
ADFI = Average daily feed intake; ADG = Average daily gain; FCR = Feed conversion ratio

Table 3: Apparent nutrient digestibility of the forages fed to the weaner rabbits

Parameters (g/100g)	*Centrosema pubescens*	*Tephrosia candida*	*Moringa oleifera*	SEM
Dry Matter	62.05^{a}	61.78^{b}	58.01^{c}	0.48
Crude Protein	81.24^{c}	83.72^{b}	84.71^{a}	0.68
Crude Fibre	48.43^{b}	44.47^{c}	67.75^{a}	0.39
Ether Extract	60.31^{a}	50.88^{b}	48.50^{c}	0.40
Ash	72.36^{a}	65.86^{b}	60.46^{c}	0.54
NFE	54.06^{b}	55.89^{b}	50.48^{c}	0.34

^{a,b,c} means on the same row with different superscripts are significantly different ($P<0.05$)
NFE = Nitrogen free extractives

Table 4: Nitrogen utilization of the forages fed to rabbits

Parameters (g/day)	*Centrosema pubescens*	*Tephrosia candida*	*Moringa oleifera*	SEM
Nitrogen intake	3.03^{c}	3.34^{b}	3.52^{a}	0.06
Faecal Nitrogen	0.57^{a}	0.54^{c}	0.60^{a}	0.01
Urinary Nitrogen	0.63^{b}	0.53^{c}	1.00^{a}	0.02
Total Nitrogen loss	1.20^{b}	1.07^{c}	1.60^{a}	0.04
Nitrogen balance	1.83^{c}	2.27^{b}	2.52^{a}	0.03
Nitrogen retention (%)	60.39^{c}	67.80^{b}	71.60^{a}	0.55

^{a,b,c} means on the same row with different superscripts are significantly different ($P<0.05$)