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Growth Performance and Apparent Nutrient Digestibility of Grower Rabbits Fed Combinations of Concentrate with Grass and/or Legume Forage

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Abstract

To reduce reliance on expensive concentrate diets in feeding of rabbits has become necessary and so the assessing of the use of forages in combination with concentrates in order to improve productivity and profitability. The study investigated the effect of feeding concentrate in combination with grass and legume on growth performance and apparent nutrient digestibility of grower rabbits. Twenty (20) mixed breed, grower rabbits of both sex were used for a ten (10) week experiment. The rabbits were balanced for sex and five (5) rabbits allotted to four (4) treatments in a completely randomized design i.e. C (solely concentrate diet), C+G (equal mixture of concentrate/*Pannicum maximum*), C+L (equal mixture of concentrate/*Leucaena leucocephala*) and C+G+L (equal mixture of concentrate/*Pannicum maximum*/*Leucaena leucocephala*). Animals were managed in individual hutches and fed experimental diet for 70 days after 7 days of acclimatization. Result of this study indicates that daily weight gain, daily feed intake and feed conversion ratio were significantly ($p<0.05$) affected by the feeding of combinations of concentrate and/or *Pannicum maximum* or *Leucaena leucocephala* when compared to solely concentrate diet feeding. However, Crude protein, crude fibre, ether extract, and nitrogen free extract digestibility were not significantly ($p>0.05$) affected by the feeding of combinations of concentrate and/or *Pannicum maximum* or *Leucaena leucocephala*. The study concludes that feeding of equal mixtures of concentrate and *Leucaena leucocephala* will reduce over reliance on concentrate without affecting the growth performance of grower rabbits.

Key words: Concentrate, Pannicum maximum, Leucaena leucocephala, Grower rabbits, Growth performance, apparent digestibility.

Introduction

It has been reported that supply of protein concentrates for non-ruminants feeding in the tropics has become a challenge over the years [1]. This is due to high cost of animal feed ingredients especially of protein source in Nigeria. This high cost has increased the demand for inclusion of vegetable-based protein sources in livestock diets. Forage use in feeding rabbits is a common practice. The forage alfalfa is widely used as a major ingredient in rabbit diets with good performances recorded. Feeding rabbits solely on forages in the tropics has resulted in negative effects of weight loss [2,3] and in some cases positive effects have been reported [4]. The use of compounded concentrates alone has also not given optimum results neither. The use of high concentrates and low forage levels currently practiced by rabbit farmers leads to high cost of production, thus high cost of rabbits. [5] evaluated the nutritive potential of pigeon pea (*Cajanus cajan)* grain and leaf meals on growth performance of pre-pubertal rabbits in the tropics and reported that the growth performance

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was not significantly affected by the dietary treatments. [6] investigated the potential of using Mulberry leaves (Morus spp) in rabbit production on feed intake, weight gain, and nutrient digestibility and concluded that mulberry leaves could support feed intake and digestibility with satisfactory weight gain in rabbits up to 50%, and could reduce reliance on and cost of expensive concentrate diets. [7] evaluated the use of hybrid poplar (Populus spp.) leaves as rabbit feed under tropical conditions. Better performance was observed when hybrid poplar was included in diet as compared to the use of alfalfa meal. Although, digestibility was lower in those fed diets with hybrid poplar. [8] reported that rabbits fed *Stylosanthes guianensis* and *lablab*, compared favourably with those fed sunflower leaf in terms of feed intake, weight gain and feed conversion ratio.

Leucaena leucocephala is said to be palatability and a source of high-quality nutrients for livestock which makes it a novel browse plant for rabbits and other ruminant animals [9]. Not all rabbit trials with leucaena have been positive. [10] reported that when dried leuceana replaced wheat bran in the diet of growing rabbits, performance decreased when more than 10-15% leuceana was included. The inclusion of fresh leucaena leaves at 20-25% had deleterious effects on the survival of female and young rabbits (up to 55% mortality), (The recommended inclusion rate ranges from 24-40% for growing or fattening rabbits fed on fresh *Leucaena leucocephala* leaves [12-14]. Rabbits fed on *Panicum maximun* had a higher feed intake and Guinea grass voluntary intake was 75% of the overall intake [14]. It was also a good fibre complement in water spinach-based diet. However, it was reported to decrease digestibility coefficients when added at 23% of the diet ([15]. However, there is little information on the percentage combination of either *Leucaena leucocephala* leaves with concentrate feed or *Leucaena leucocephala* leaves and *Panicum maximum* leaves. This research, therefore seek to investigate the effect of both forage and/or concentrate combinations on growth performance and apparent nutrient digestibility of rabbits.

Materials and Methods

Experimental site

The research was conducted at the Rabbits Unit of the Livestock Teaching and Research Farm of the University of Agriculture Makurdi, Benue State, Nigeria. Makurdi lies on latitude 7^0 44' North and Longitude 8^0 31' East, and it's within the Southern Guinea Savannah agro ecological zone of Nigeria. The area has an annual rainfall between 6-8 months (March to October) and ranging from 508 to 1016mm with a minimum temperature range of 24.20 + 1.4^0C and maximum temperature range of 36.33 + 3.70^0C, respectively. The relative humidity ranges between 39.50 + 2.20% and 64.00 + 4.80% (TAC, 2009).

Preparation of test ingredients

Pannicum maximum and *Leucaena leucocephala* leaf meals were prepared individually by air-drying the leaves on a concrete floor inside a well-ventilated house to preserve their nutritive values as much as possible. The dried leaves were then milled in to *Pannicum maximum* leaf meal and *Leucaena leucocephala* leaf meal to be combined with concentrate to form experimental diets.

Experimental design and procedure

A concentrate diet used was formulated to meet the nutrient requirement of the rabbit (Table 1). Twenty (20) mixed breed, weaner rabbits of both sex were obtained from a reputable, disease free rabbit farm and used for a ten (10) week experiment. The rabbits were balanced for sex and five (5) rabbits allotted to four (4) treatments in a completely randomized design with each rabbit serving as a replicate. The rabbits were allowed to acclimatize to the new environment for a period of seven (7) days, after which, Live weight differences between treatment groups was minimized. Individual rabbits were given feed and fresh water *ad-libitum.* The treatment diets are as follow:

T1- Solely concentrates (C)

T2- equal mixture of concentrate/*Pannicum maximum* (C+G)

T3- equal mixture of concentrate/*Leucaena leucocephala* (C+L)

T4- equal mixture of concentrate/*Pannicum maximum*/ *Leucaena leucocephala* (C+G+L)

Data Collection

Growth performance- Weight change and feed intake

Weight change of the rabbits was obtained on weekly basis by determining the average weight change of the rabbits per treatment for the week and subtracting from the previous week. Feed intake was determined by subtracting feed left over from feed offered to the animals. Feed conversion ratio (FCR) was determined by calculating the ratio of daily feed consumed in gram to total weight gain in gram per treatment.

Apparent nutrient digestibility

At the end of the feeding trial, three (3) rabbits, with live weights approximating their treatment average live weight, were selected from each treatment and used for the digestibility trial. Feacal collection lasted for five (5) days. During this period; the rabbits were fed 90 % weight of their daily feed intake per day to ensure total feed intake (Ikyume

Table 1: Composition of concentrate used in the experiment.

Ingredient	% composition
Maize	35
Maize offal	6
Full fat soybean	27.55
Brewers dried grain	5
Rice offal	22.95
Bone meal	2.5
Premix	0.25
Table salt	0.3
Methionine	0.25
Lysine	0.2
Total	**100**

Table 2: Proximate composition of experimental diets

Parameter	T1	T2	T3	T4
Dry matter	89.01	88.98	86.51	87.97
Ether extract	3.87	2.05	2.83	2.4
Crude protein	12.29	15.73	22.76	17.4
Crude fibre	11.71	16.17	14.52	17.88
Ash	9.43	12.35	15.34	12.46
NFE	51.71	42.68	31.06	37.83
ME (Kcal/kg)	2598.48	2264.84	2176.24	2183.09

et al., 2017). Nylon nets were tied under individual cages for daily feacal collection. Before the commencement of feacal collection, the rabbits selected were deprived of feed for 18 hours to ensure that feacal collection corresponded to the feed offered. The fresh feaces collected was weighed and oven dried at 80^0C for 24 hours, and bulked by replicate, stored in airtight containers for proximate analysis of the treatment diets (Table 2) and faeces according to A.O.A.C (2005). Digestibility coefficients were calculated using the following equation:

$$\text{Percentage digestibility} = \frac{\text{Quantitiy in feed - Quantity in faeces}}{\text{Quantitiy in feed}} \times 100$$

Statistical Analysis

All the data generated were subjected to the analysis of variance (ANOVA) using SAS (2000) Statistical Software. Significant ($p<0.05$) differences were separated using Duncan New Multiple Range Test.

Result and Discussion

Growth Performance of Rabbits Fed Concentrates and/or in combination with *Leucaena leucocephala* and *Pannicum maximum* Forages

Feed intake was significantly ($p<0.05$) different across the treatment groups. The average feed intake (36.11 – 50.54 g) observed in this study was lower than those reported by [16-18], lower values could be attributed to the presence of anti-nutrients like mimosine in grasses and legumes; an appetite depressant by the action of 3, 4 - dihydroxyl pyridine as reported by [18] and Tannin; which have an astringent taste leading to low feed intake [19]. The least feed intake (36.11 g) was observed in the equal mixture of concentrate, grass and legume (C+G+L). This could be attributed to the lower quantity of concentrate in the diet when compared to other diets.

Weights gain differs significantly ($p<0.05$) across the dietary treatment. Rabbits in C+G had the lowest weight gain (3.47 g) which could be attributed to the poor quality of the grass (Pannicum maximum) included in the diet compared to either concentrate and legume (Leucaena leucocephala). The weight gains obtained in this report (3.47-14.41 g) are higher than those obtained by who fed rabbits with graded levels of soybean cheese waste/maize offal and brachiaria hay, who fed concentrates supplemented with forages to grower rabbits. Weight gains in this report was however lower than those reported by other researchers [21-23]. These differences could be as a result of the kind of forages used in their researches as these authors all fed fresh leafy forages alongside concentrates to their rabbits in contrast to feeding dried forages in this report. Rabbits on C+L diets had daily weight gain that was similar to the findings of [24] who evaluated different processing methods of *Leucaena leucocephala* leaf meal in rabbit's diet. Other researchers have observed a reduction in the growth performance of rabbits fed *Leucaena leucocephala* leaf meal at different processing and inclusion level and they all attributed their findings to the presence of anti-nutrients present in *Leucaena leucocephala,* [25-27] stated that anti-nutrients are prevalent in legumes. Result of this study is comparable with [28-29]. except for C+G diet (3.47 g) which was very low compared to these authors.

C and C+L groups had statistically similar values of feed conversion ratio (FCR) but differed significantly ($p<0.05$) from C+G and C+L+G groups. The difference in the FCR implies that the rabbit was able to convert more efficiently the concentrate and the legume forage. Result of C, C+L and C+G+L groups for FCR are comparable those of other researchers [30-31], [29] but lower than those reported by [32]. However, FCR value of C+G group (11.96) which is poor compared to the other dietary treatments is similar to the reports of [24].

Apparent Digestibility by Rabbits Fed Concentrate and/or in Combination with *Leucaena leucocephala(legume)* and *Pannicum maximum* (Grass) Forages

There was no significant ($p>0.05$) difference in any of the parameter measured. Dry matter (DM) digestibility obtained in this study ranged from 72.16-80.29%, these values were slightly higher than the reports by other researchers [33-35], [24] but comparable with findings of Omole, *et al.,* 2003). The Crude protein (CP) digestibility values for this study was in the range of 71.86-76.15%, the highest value of 76.15% recorded in rabbits fed diet containing *Leucaena leucocephala* leaf meal (C+L) contrast the report of [36-37, [24] who postulated that the presence of mimosine in *Leucaena leucocephala* exerts toxic action by blocking the metabolic pathways of aromatic amino acids and typtophan. The CP digestibility of this study were within the range recorded by [38] [34], higher than the findings of [39] who fed moringa leaf meal on the digestibility of weaner rabbits but lower than the values reported by [40]. The Ether extract (EE) digestibility values were higher than the findings of Adeyemi

Table 3: Growth performance of rabbits fed concentrate diet and/or grass/ legume.

Parameter	T1	T2	T3	T4	SEM
Initial weight (g)	496.4	497.6	502.8	494	26.66
Final weight (g)	1504.80^a	740.40^d	1180.40^b	909.00^c	69.81
Weight gain (g)	1008.40^a	242.80^d	678.40^b	415.00^c	67.69
Daily weight gain (g)	14.41^a	3.47^d	9.69^b	5.93^c	0.97
Daily feed intake	50.54^a	41.03^{ab}	45.02^{ab}	36.11^c	1.48
FCR	3.57^a	11.96^c	4.69^a	6.14^b	0.77
Mortality	0	40	20	40	

Table 4: Apparent nutrient digestibility of rabbits fed combinations of concentrate, grass or legume

Parameter (%)	T1	T2	T3	T4	SEM
Dry matter	75.04	76.5	72.16	80.29	3.04
Crude protein	71.86	72.45	76.15	74.05	1.37
Crude fibre	85.53	83.82	84.21	87.88	1.03
Ether extract	73.56	79.91	71.38	71.42	2.09
NFE	62.2	68.84	65.9	67.41	1.59

et al. (2014) but slightly similar to those of [24]. Ether extract digestibility is an indication of better utilization of dietary fat present in the diets by providing the rabbits essential fatty acids and improve their energy utilization. Crude fibre (CF) values were higher than the reports of [34],[41], [24]. High values of fibre digestibility is an indication that rabbits used in this research efficiently utilized the fibre in the diet. Nitrogen free extract (NFE) digestibility coefficients were similar across the treatment groups. This was marginally higher in the diet containing the leaf meal forages. Higher NFE in these diets could be attributed to high fibre content in the diet as there is considerable extraction of energy from the fibrous feeds in other that the rabbits could satisfy their energy requirement.

Conclusion

The feeding of concentrate and/or *leucaena leucocephala* and *Panicumm maximum* influenced the growth performance of grower rabbits even though apparent nutrient digestibility was not affected.

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