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Effect of feeding mango leaf and time of concentrate feeding on the performance and carcass characteristics of growing rabbit's bucks.

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Abstract

An 84-day feeding trial was conducted using 36 rabbits with the aim of studying effect of time of feeding concentrate on the performance and carcass characteristics of growing rabbits fed mango leaves as basal diet. The experimental animals were randomly allocated to three feeding time regimes (T1-animals fed concentrate in the morning (7: 00 am), T2-animals fed concentrate in the afternoon (12:00 noon) and T3-animals fed concentrate in the evening (6: 000 pm)) and replicated twelve times in a completely randomised design. Concentrates were fed 30 percent of the body live weights of the animals. Results of the analytical experiment showed that there were no significant (p>0.05) differences among treatments in the final body weight gain, mean total body weight gain and total feed intake of the experimental rabbits. There were no significant (p>0.05) differences in the fasted weight, carcass weight, slaughter weight and dressing percentage as well as the relative weights of heart, kidney, liver, spleen and lungs among treatment groups. It is obvious from the result of this study that the time of feeding concentrate has no effect in the performance and carcass characteristics of growing rabbits.

Keywords: Concentrate, Mango leaves, Rabbits, Performance, Carcass, Time of feeding.

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Description of Problem

Rabbit production has gained considerable interest recently in Nigeria because of the exorbitant prices of the conventional sources of meat, such as cattle (beef), sheep (mutton), pig (pork), and poultry. Increasing demand and consequently high cost of conventional animal feed ingredients in the tropics has created the need for sustainable alternatives, particularly natural feed resources indigenous to the region [1]. Rabbits are renowned for their fecundity and prolificacy [2]; ability to utilize forages [3].

The rabbit has other immense potentials resulting from attributes such as high growth rate, ability to convert forage to meat, short gestation period, relatively low cost of production, high nutritional quality of rabbit meat which includes low fat, sodium and cholesterol levels. Rabbit meat also has a high protein level, about 20.8% [4]. The presence of caecal microbes enables the rabbit to digest large amounts of fibrous feeds, unlike most non ruminant species.

Rabbit production system practiced by most small holders is mainly forage-based. In order to guarantee maximum productivity, Ojebiyi et al. [5] reported that rabbits, especially the newly weaned ones should not be maintained on sole forage without a little supplement of a balanced concentrate. Rabbits can, however, be successfully raised on diets that are low in grains and high in roughage. Growing rabbits can be fed diets consisting of 100 g to 200 g green roughage and 40 g to 60 g concentrate mixtures for maximum productivity [6].

Rabbits have been found to perform best when fed with a combination of roughages and concentrates. When fed with concentrate feeds such as corn or wheat bran, they produce larger litters and the kids grow faster than when the doe is fed forages alone. This is because concentrate feed mixtures supply higher quantities of the primary nutrients (carbohydrates, protein and fat).

In recent years, there has been an increased interest in studying feed restriction in rabbits as a means of reducing cost of production. Early feed restriction also helps to address problems associated with early-life fast growth rate such as increased body fat deposition, high incidence of metabolic disorders and high mortality. Limited feed intake depresses growth rate during the period of restriction [7].

Rabbit production is affected by many factors such as environment, time of feeding and type of nutrition. Reports on effect of feed type and time of feeding on the performance of rabbits is scarce [8]. These factors should be considered as they could influence the number of meal per day, quantity consumed, overall intake and productivity of rabbit's performance [9]. Determining the best time to feed rabbit, therefore, will help to maximize performance, discourage waste of feed and ensure the success of rabbit production.

Materials and Methods

Experimental site

The study was conducted at the Rabbit Unit of the National Veterinary Research Institute, Vom. Vom is located in Jos South Local Government Area of Plateau State, North Central Nigeria with geographical coordinates of Latitude 9° 43.49′ North and Longitude 8° 47.92′ East of the Equator. Jos is the capital city of Plateau State, located at an elevation of about 1,238 m above sea level. Average monthly temperature ranges from 21-25°C and from mid-November to the late January, night time temperature drops as low as 11°C.

Source of the mango leaves

Mango leaves, as basal diet, were also given to the rabbits alongside the concentrate feed. The leaves of mango tree were harvested from the mango plants, which abound in and around the National Veterinary Research Institute. The leaves were air-dried overnight under the shade, in order to avoid bleaching of the green colour, until they became crispy. The leaves were then fed to the animals. Proximate composition of the mango leaf and experimental diets were determined.

Experimental diets

Concentrate feed meeting all the requirements for growing rabbits was formulated. The composition of concentrate fed during the trial is shown in Table 1.

Management of experimental animals and design

A total of thirty six (36) rabbits with average weight of 600 g of mixed breed and mixed sexes were used for this experiment. They were purchased from a private farm in Jos. The rabbits were housed in wood/wire hutches individually in cages measuring (60 × 60 × 50) cm raised 60 cm above ground level in an open sided shed for proper ventilation. The hutches were cleaned and disinfected seven days before the arrival of the rabbits. Each cage contained a feeder and a drinker, properly secured against tipping to curtail feed and water wastage. The rabbits were allowed one week period of acclimatization to the environment before the commencement of the experiment, during which they were treated for both ecto and endo parasites. At the end of the acclimatization period, each rabbit was weighed to obtain the initial weight. The rabbits were assigned to three treatments in a Completely Randomized Design (CRD) as follows:

Treatment 1 (T1): Experimental animals fed at 07:00 h.

Treatment 2 (T2): Experimental animals fed at 12:00 h.

Treatment 3 (T3): Experimental animals fed at 18:00 h.

Ingredients	Percentage inclusion
Maize	30.16
Soya bean meal	28.12
Rice offal	35.32
Vitamin premix	0.50
Palm oil	1.0
Bone meal	4.0
Methionine	0.4
Common salt	0.50
Total	100
Calculated nutrients	**Composition**
M.E (cal/kg)	2,510.76
Crude protein	15.49%
Crude fibre	13.88%
Ether extract	9.24%
Calcium	1.64%
Phosphorus	1.10%
Ash	8.43%
Lysine	0.81%
Methionine	0.63%
Arginine	1.04%

Table 1. *Composition of concentrate feed.*

Each treatment was replicated twelve times. The concentrate feed, being the experimental diet, was fed for three hours daily while mango leaves were given to the animals *ad libitum* daily for 12 weeks.

Experimental parameters

Data were collected on the following parameters:

Feed intake (FI): A known weight of feed (30% of animal's live bodyweight) was offered to individual rabbit every day. The left over feed was weighed after three hours and the feed intake was determined by difference.

Average daily weight gain (ADWG): The rabbits were weighed weekly and the difference in weight was divided by 7 to determine the daily weight gain (Table 2).

Evaluation of carcass parameters: At the end of the feeding trial, three rabbits per treatment, with live weight approximate their treatment mean live weight, were selected for slaughter and their carcasses were evaluated. The rabbits were starved for 18 hours before slaughter so as to reduce the volume of the gut contents and therefore reduce the risk of contamination of the carcass during dressing. Each rabbit was weighed and then slaughtered by cutting the jugular vein with a sharp knife and allowed to bleed thoroughly. The carcasses were eviscerated and singed, washed and weighed. The visceral organs, which includes; the heart, stomach, lung, kidney, liver, and spleen were carefully removed and weighed on an electronic weighing balance. The weights of visceral organs were expressed as weight of organ over the dressed weight. The final live body weight, fasted weight, slaughter weight (bled weight) and the carcass weights were determined. The carcass weight (dressed weight) was determined by weighing the animal after removing all the internal organs when butchered.

Dressing percentage=(Dressed weight/slaughter weight) 100.

Mortality: Records of the mortality rate was kept throughout the experimental period.

$$\text{Mortality} = \frac{\text{No. of dead Rabbits}}{\text{Total no. of Rabbits in the Treatments}} \text{x}100$$

Feed conversion ratio (FCR): Feed conversion efficiency was calculated as the quantity of feed that produced 1 kg weight gain. This was computed using the expression:

$$\text{FCR} = \frac{\text{Feed intake } (\text{g})}{\text{Weight gain } (\text{g})}$$

Chemical analysis: Proximate analysis of the concentrate feed and mango leaf as well as the faecal samples were carried out using the procedure of A.O.A.C.

Nutrients	Concentrate feed	Mango leaf
Dry matter	94.82	53.12
Crude protein	18.38	17.20
Ether extract	4.59	5.81
Crude fibre	9.84	22.40
Ash	6.42	11.25
Nitrogen free extract	60.77	43.34

Table 2. *Proximate composition of the concentrate feed and mango leaf (% DM).*

Statistical Analysis: All data generated data from this experiment were subjected to analysis of variance (ANOVA) using minitab statistical software for completely randomized design (CRD). Sets of means that were significantly different from each other were separated using Tukey's Family Error Rate Method.

Results and Discussion

Proximate composition

The proximate composition of mango leaf showed lower values in crude protein (17.20%), Nitrogen free extract (43.34%) and dry matter (53.12%) when compared with concentrate feed of 18.38%, 60.77% and 94.82% values of crude protein, NFE and dry matter respectively (Table 3).

On the other hand, the values of ash (11.25%), ether extract (5.81%), crude fibre (22.40%) are higher in mango leaf than the concentrate feed values of ash (6.42%), ether extract (4.59%) and crude fibre (9.84%), respectively.

The high crude fibre content of *Mangifera indica* leaves observed might have accounted for the lower intake. Aduku et al. [10] also observed that mango leaf was poorly accepted by rabbits. The values for crude protein, crude fibre and ether extract obtained in this analysis correspond to the values reported by Jokthan et al. [11].

Performance indices

There were no significant differences (P>0.05) in the initial body weights of rabbits among the treatment means (605.83 g-614.58 g). This is an indication that the experimental animals were balanced for weights. Weight gain (total and average daily), final body weight, feed intake (total and average daily) and feed: gain ratio of rabbits were not significantly (P>0.05) different among the treatment groups.

Effect of time of feeding concentrate on the performance of growing rabbits did not have significant effect on daily weight gain. This result contradicts the report of Esonu et al. [12] who observed a reduced weight gain in rabbits.

Although total feed intake was not different among the three treatments, total concentrate intake was significantly higher in rabbits on treatment 2 (rabbits fed in the afternoon) compared with rabbits on treatment 3 (rabbits fed in the evening) which was also higher than treatment 1 (rabbits fed in the morning). Average daily concentrate intake reduced from 32.47 g on both treatments 2 and 3 to 31.87 g in treatment 1.

Effect of time of feeding concentrate did not have significant difference on feed intake across the treatment in this study. Earlier study on time of feeding reported that feed intake was higher in the evening and morning as these times were the hours of greatest feed requirement and feed intake by rabbits [9]. In their own experiment, it is shown that rabbits utilize early hours of the morning and late hours for feeding which is in agreement with the findings of Van Den Buuse and Malpas [13]. The similarity in the time of feeding in this study shows that the domestic rabbits can eat at any time depending on feed availability, environmental conditions and the physiological state of the animal [14].

Effect of time of feeding concentrate did not have significant (P>0.05) effect on feed conversion ratio in this study. Statistically, there were no significant difference (P>0.05) in the feed conversion ratio among the treatment means. However, rabbits on treatment 2 (rabbits fed in the afternoon) required less feed to produce a one-gram gain in the body weight (6.18) and also showed a better conversion of feed to meat. This was followed by the animals on treatment 1 (rabbits fed in the morning) and treatment 3 (rabbit fed in the evening) respectively. Perrier and Gidenne [15,16] reported improved feed efficiency in rabbits at restricted feeding period (Table 4).

Anti-nutrients	Content (mg/100g)
Alkaloid	0.01
Tannins	1.03
Phytate	1.44
Cyanide	0.00
Saponin	0.04
Oxalate	1.49
Trypsin inhibitor (TIU/mg)	18.42

Table 3. *Anti-nutrient content (mg/100 g) of mango leaf.*

Performance Indices	T1	T2	T3	P-value	SEM	LS
Initial weight (g)	614.58	605.83	613.33	0.40	4.88	NS
Final weight (g)	1586.74	1610.47	1591.93	0.73	22.08	NS
Total weight gain (g)	972.16	1004.64	978.53	0.58	22.93	NS
Average daily weight gain (g)	11.57	11.96	11.65	0.58	0.07	NS
Total feed Intake (g)	6099.50	6158.30	6175.10	0.59	55.16	NS
Average daily feed intake	72.60	73.31	73.51	0.59	0.65	NS
Total concentrate Intake (g)	2677.60	2728.20	2692.50	0.58	34.40	NS
Average daily concentrate intake	31.87	32.47	32.47	0.48	0.40	NS
% concentrate in daily feed Intake	43.88	44.29	44.10	0.64	0.29	NS
Total forage Intake (g)	3420.80	3429.90	3442.30	0.89	31.80	NS
Average daily forage Intake (g)	40.72	40.83	40.98	0.89	0.37	NS
% forage in daily feed Intake	56.10	55.69	55.58	0.42	0.29	NS
Feed conversion Ratio	6.31	6.18	6.34	0.78	0.23	NS
Mortality	0.83	0.00	0.00	0.38	0.05	NS

T1: Experimental diet fed at 07:00 h; T2: Experimental diet fed at 12:00 h; T3: Experimental diet fed at 18:00 h.
SEM: Standard Error of Mean; LS: Level of Significance; NS: Not Significant.

Table 4. *Effect of time of feeding concentrate on the performance of growing rabbits.*

No significant difference (P>0.05) was observed in the mortality rate of rabbits among the treatment groups. The only mortality recorded in rabbits in treatment 1 could be linked to the observed loss of appetite. The present finding is in agreement with Osman [17] that feed restriction did not affect mortality of rabbits.

From this experiment, it can be revealed that time of feeding concentrate has no effect on the performance of growing rabbits. This implies that rabbits can be fed anytime of the day or night. This is because the animals are caged and housed and their activities are restricted. They can feed anytime due to feed availability unlike animals in the wild whose activities are reduced in the day due to high temperature or heat stress and active at nights when the environment is cooler.

Carcass yield and visceral organ characteristics

There were no significant differences (P>0.05) in the fasted weights of rabbits among treatment groups. The mean value of the fasted weight of treatment 2 (Rabbit fed in the afternoon) (1574.35 g) was however, higher than those of the animals in treatment 1 (animals fed in the morning (1543.16 g)) and then treatment 3 (those animals fed in the evening (1545.97 g) respectively. No significant differences (P>0.05) in the slaughter weight of rabbits were observed among the treatments. The values ranged from 1518.16 g to 1549.35 g. However, the animals fed in the evening gave better performance, followed by the afternoon and then the ones fed in the morning (Table 5).

The slaughter weight values obtained in this study were a reflection of the fasted weights. The treatment groups were also not significantly different (P>0.05) from each other in carcass weights. The values obtained ranged from 980.33 g-1007.58 g. Yakubu et al. [18] got a similar result in terms of carcass weight, fasted live weights and slaughter weights of rabbits. In their own experiment, they also observed no significant difference (P>0.05) in the fasted live weight, carcass weight and slaughter weights of rabbits. However, the mean values of fasted live weight, carcass weight and slaughter weights of rabbits as reported by Yakubu et al. [18] ranged from 1175-1387.50 g, 605.5-740.33 g, 1130-1337.50 g, respectively.

The result obtained revealed that the difference among the treatment groups in dressing percentage were not significant (P>0.05). The values obtained ranges from 63.33-63.90% which are higher than the values obtained for dressing percentage, 52.05-53.36% reported by Sobayo et al. [19]. The non-significant effect of time of feeding on dressing percentage was in agreement with the results of Tumova [20,21] who reported that restriction did not affect dressing percentage but at variance with the report of Lebas [22] that in the middle of the restriction period, dressing percentage was higher in restricted rabbits in comparison with the *ad libitum* fed ones. No significant differences were observed in the relative weights of liver among treatment groups. The values for T1 (rabbits fed in the morning), T2 (rabbits fed in the afternoon) and T3 (rabbits fed in the evening) were 2.675 g, 2.628 g and 2.663 g, respectively.

There were no significant (P>0.05) difference in the weights of kidney among treatment groups. The values obtained were 0.33 g, 0.32 g and 0.33 g for rabbits who fed in the morning, afternoon and evening respectively. This result agrees with the study conducted by Yakubu et al. [18] who reported similar results where feed restriction did not have any significant effect on kidney weight.

Also, there was no significant difference (P>0.05) in the relative weights of lungs among treatment groups. Rabbits in the evening had a higher value than values fed in the morning and afternoon. This result where there was no significant difference observed among treatment groups.

No significant difference (P>0.05) were found in the relative weights of spleen among treatment group means. The relative weights were 0.066 g, 0.063 g and 0.061 g for rabbits fed in the morning, afternoon and evening. There were no significant differences (P>0.05) among treatment means in relative weight of hearts. Rabbit fed in the morning, afternoon and evening all had 0.21 g. This result agrees with the findings of earlier works that feed restriction did not significantly affect the weight of the heart [20].

Carcass indices	T1	T2	T3	P-value	SEM	LS
Fasted weight (g)	1543.16	1574.35	1545.97	0.78	34.35	NS
Carcass weight (g)	981.73	1007.58	980.33	0.80	32.39	NS
Slaughter weight (g)	1518.16	1525.14	1549.35	0.80	34.37	NS
Dressing percentage	63.55	63.90	63.33	0.87	0.76	NS
Weight of internal organ (% of live weight)						
Heart	0.21	0.21	0.22	0.73	0.01	NS
Kidney	0.33	0.32	0.34	0.71	0.01	NS
Liver	2.68	2.63	2.66	0.93	0.08	NS
Spleen	0.07	0.06	0.06	0.72	0.00	NS
Lungs	0.52	0.52	0.53	0.50	0.01	NS

T1: Experimental diet fed at 07:00 h; T2: Experimental diet fed at 12:00 h; T3: Experimental diet fed at 18:00 h.
P=level of Probability
SEM: Standard Error of Mean; LS: Level of Significance; NS: Not Significant.

Table 5. *Effect of time of feeding concentrates on the carcass yield and visceral organ weights of growing rabbits.*

Conclusion

1. The results obtained from this study have indicated that time of feeding concentrate has no effect on the performance of growing rabbits.
2. Also, it was observed that effect of time of feeding concentrate has no significant difference on carcass characteristics and visceral organ weights of growing rabbits.

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