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Influence of Lysine Supplementation on the Reproductive Performance of Rabbits in a Tropical Environment

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Abstract: The effect of dietary lysine supplementation at varying levels on the reproductive performance of rabbits of mixed breed was investigated. A total of twenty (20) does with average weight of 1.85kg were used for the study in a Completely Randomized Design (CRD). The experimental diets consisted of concentrate mash (16.87% CP and 2564.84 kcal kg^{-1}ME) supplemented with 0.00, 0.10, 0.20, 0.30 and 0.40 lysine levels, respectively, designated as diets 1, 2, 3, 4 and 5 with 4 replications having one doe per replicate, thus making a total of 4 rabbits per treatment. The experiment lasted 11 weeks (77 days). The results showed that the various parameters among which are gestation length, average litter size at birth, litter weight at birth, litter weight and size at weaning were not significantly influenced ($p>0.05$). Nonetheless, rabbits fed diet 3 gave the best mean litter weight (1272 g) at weaning, while diet 2 has the highest (5.44) weaning size. It was also observed that individual kit weaning weight differed from treatment to treatment depending on the litter size at weaning; the higher the litter size at weaning the lower the individual weaning weights. In conclusion, lysine supplementation and total dietary lysine in rabbit diets should not exceed 0.20% and 1.01%, respectively.

Key words: Lysine supplementation reproductive tropical environment

INTRODUCTION

The most advantageous attributes of rabbits are their high reproductive potential and fast growth rate[1]. This is due to their short gestation length, early sexual maturity, high prolificacy and ability to rebreed shortly after parturition[2]. Reports on reproductive performance of rabbits in the tropics have been documented[3-5].

Egbunike and Ladokun[6] observed that nutrition plays a vital role in enhancing the reproductive capacity of an animal and the overall increase of animal products such as meat, milk and egg. Nutrition involves chemical reactions and physiological processes which transforms food into body tissues and activities. The essence of nutrition, therefore, is to provide all essential nutrients in adequate amounts and optimum proportions. Thus quantitatively, it is important that diets containing sufficient digestible protein be fed, so as to replace that which is lost during tissue renewal and also ensure high reproductive and productive performances.

Egbunike and Ladokun[6]noted that, although crude protein requirements of rabbits have been placed between 18 and 22% in a tropical environment, there has not been any planned investigation on the effects of dietary protein on development and puberty in the buck. Boa[7] reported good reproductive performance of does fed diets of 2500 to 2900 calories of digestible energy per kg of diet. It is also known that lysine requirements during lactation is influenced by energy intake. Lebas *et al.*,[1] reported that growing rabbits need feed that contains essential amino acids. They further stated that lactating does need the richest concentrate feed. In various studies, the quantity of amino acids needed is confined to arginine, lysine, methionine and cystine[1]. These authors also observed that the amino acid requirements of lactating does correlated with the production and composition of milk. They recommended that lysine requirements of the breeding does should be considerably higher under intensive milk production to feed 9 – 12 young. Boa[7]on the other hand, stated that 0.60, 0.65, 0.60% of arginine, lysine and methionine plus cystine respectively are basic requirement for breeding does. Lactating does produce milk three times richer than cow's milk, at the rate of 100 to 300 g per day, and have few reserves in relation to the demand made on them. Thus, they require a highly nutrient-balanced diet[1]. They further observed that rabbits will always eat more of a balanced diet containing essential amino acids than the same feed without these amino acids.

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Table 1: Percent composition of diets containing graded levels of lysine fed to rabbits for 11 weeks.

	Diets				
Ingredient	1	2	3	4	5
White maize	40.00	40.00	40.00	40.00	40.00
Soyabean meal	15.00	15.00	15.00	15.00	15.00
Brewer's dried meal	19.25	19.20	19.15	19.10	19.05
Palm kernel meal	19.25	19.20	19.15	19.10	19.05
Bone meal	3.50	3.50	3.50	3.50	3.50
Oyster shell	2.50	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25	0.25
*Vitamin mineral premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis:					
Methionine (without supplement)	0.31	0.31	0.31	0.31	0.31
Lysine (without supplement)	0.81	0.81	0.81	0.81	0.81
Lysine (with supplement)	0.81	0.91	1.01	1.11	1.21
% crude protein	16.87	16.87	16.87	16.87	16.87
Metabolizable energy (kcal kg^{-1})	2564.84	2564.84	2564.84	2564.84	2564.84

*Composition: 2.5kg per tonne (vitadiz BCP): Vit A. 10,000,000 .I.U., Vit. D_3 2000,000 I.U; Vit E. 20000 I.U, Vit K. 2250 mgr, Vit E. 20000. I.U; Vit K. 2250mgr; Thiamine. B_1, 1750mgr; Riboflavin B_2mgr; Pyridoxine, $B_6$270mgr, Niacin 27500mgr, Vit B_{12}15mgr; Pantothenic acid, 7500mgr; Folic acid, 7500mgr; Biotin. 50mgr; Chlorine chloride, 400gr; Antioxidant, 125gr; Manganese, 80gr; Zinc 50gr; Iron, 20gr; Copper, 5gr; Iodine, 1.2gr; Selenium, 200mg

Table 2: Effect of lysine supplementation on the reproductive performance of rabbits

	Dietary treatments						
Parameters	T_1	T_2	T_3	T_4	T_5	GM	SED
Av.No. of matings to conception	1.75	0.84	1.75	1.55	1.25	1.43	0.362
Av. Gestation Length (days)s)	30.50	30.25	31.00	30.40	30.75	30.58	0.513
Av.Litter Size at birth	5.00	5.87	6.25	4.45	6.00	5.51	1.596
Av. Litter wt. at birth (g)	239	261	253	176	258	238	45.5
Av. Wt of kit at birth (g)	47.8	46.5	40.6	42.6	43.9	44.3	5.99
Av. Litter wt at weaning (g)	983	1025	1272	963	1054	1059	242.0
Av.litter size at weaning	4.0	5.44	4.00	2.30	4.50	4.05	1.254
Av. Litter wt. gain at weaning (g)	744	763	1018	783	795	821	264.6
Av. Daily wt. gain of litter (g)	26.6	27.3	36.4	28.0	28.4	29.3	9.45
Av.Daily wt. gain of individual kit (g)	6.7	4.2	12.2	11.8	6.3	8.3	4.97
Percentage mortality	35.00	8.30	32.00	44.40	25.00	28.94	9.12

Abc: Means with different superscripts within a row are significantly different ($p<0.05$). GM: Grand Mean

This study was, therefore, undertaken to evaluate the effect of varying levels of lysine supplementation on the reproductive performance of rabbits in a tropical environment.

MATERIALS AND METHODS

Management of experimental animals: A total of 20 does (mixed breeds) with average weight of 1.85 kg were used for the study. Each doe was housed in a hutch of 75 x 60cm with a height dimension of 45cm. Prophylactic treatments against helminth infection, coccidiosis and mange were done using piperazine dewormer, Embazine forte and Ivomec, respectively. Equilibration of the rabbits lasted for 14 days during which period they were introduced to the test diets. Feed and water were supplied ad libitum throughout the experimental period. The experimental concentrate diet of 200g was supplemented with 1kg fresh succulent forage per rabbit per day. Mating was done on day 15 following equilibration of animals.

Experimental diets: The experimental diets consisted of concentrate mash (16.87% CP and 2564.84kcal kg^{-1}ME) supplemented with 0.00, 0.10, 0.20, 0.30 and 0.40 lysine levels respectively, designated as diets 1, 2, 3, 4 and 5. The composition of the diet is as shown in Table 1.

Experimental design: The experiment was a Completely Randomized Design (CRD) with the five graded levels of lysine supplemented diets as treatments. Each diet was replicated four times with one doe per replicate, making a total of four rabbits per treatment.

Parameters measured: The following parameters were measured, Gestation length of each doe, litter size at birth

and at weaning, and litter weight at birth and litter weaning weight. Mortality was determined by subtracting the litter size at weaning from the litter size by counting the number of dead kids at birth.

Statistical analysis: All data were subjected to simple descriptive statistics. Analysis of variance was in accordance with the methods of Steel and Torrie[8]Treatment means were compared using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

The results of the reproductive performance of the rabbits are presented in Table 2.

The number of mating to conception was not significantly different ($p>0.05$) among the different treatment groups. The values obtained in this study varied from 0.84 in diet 2 to 1.75 in diets 1 and 3. The mean gestation length of the rabbits in the different treatments ranged from 30.25 to 31 days. This is in agreement with the reports of Iyeghe *et al.*,[9], Aduku and Olukosi[10], Odubote and Akinokun [2]and Iyeghe – Erakpotobor *et al.*,[11]. There was also no significant ($p>0.05$) difference in the gestation length among the different treatments.

The average litter size of the treatment groups at birth also showed no significant difference ($p>0.05$). The values obtained ranged from 4.45 to 6.25. Those values are in consonance with the values (5.6) obtained by Odubote and Akinokun[2]. Iyeghe *et al.*,[9]on the other hand obtained a range of 2.3 to 5.9 while 3.94 to 6.80 was obtained by Ohiosimuan *et al.*,[5]. The average litter birth weight varied from 176g to 261g in the different groups. Diet 4 has the lowest litter birth weight (176 g) while diet 2 has the highest (261 g). Among the individual kits weighed at birth, T_1 had the highest value (47.8 g) while T_3 had the lowest (40.6 g). Litter weight at birth increased from diet 1 to 5 only with the exception of those fed D_4. The lower range in the litter birth weight in this study is in agreement with the results of Odubote and Akinokun [2]and Iyeghe – Erakpotobor *et al.*,[11]. The improvement in litter birth weight observed could be attributed to improved protein content of the feed as suggested by Ladokun and Egbunike and Iyeghe – Erakpotobor *et al.*, [11]that improved protein enhances litter weight at birth.

There was no significant difference ($p>0.05$) among the groups in mean litter weight at weaning. The litter weight at weaning ranged from 963 g in D_4 to 1272g in D_3. the overall mean of the treatments was 1059 g. Average litter weight at weaning was greatly enhanced by lysine supplementation. The improvement in weaning weight was from diet 1 to 3 and decreased thereafter. This tends to mark diet 3 as the optimum level of lysine supplementation. The recommended level of lysine is 0.65 to 0.70%[7] for young rabbits. The levels of lysine in diets 1, 2, and 3 were 0.81, 0.91 and 1.01% respectively. Beyond these levels, the weaning weights were observed to decrease.

It was observed that inclusion of sulphur-containing amino acids beyond required levels in broilers resulted in poor availability of these amino acids[12]. This could also explain the decrease in litter weaning weight of the rabbit beyond diet 3. Individual kit weaning weight differed from treatment to treatment depending on litter size at weaning. It was observed that the higher the litter size at weaning the lower the individual weaning weight.

The litter size at weaning increased from 1 to 5 except in diet 4 where the litter size at weaning is low. Diet 2 has the highest litter size at weaning although there are no significant differences ($p>0.05$) in the litter size of weaning of the different treatment diets. Diet 4 recorded the highest weaning weight gain (1018g) while diet 1 recorded the least (744 g). The average daily weight gain followed the same trend as the weaning weight.

There are variations on the average daily weight gain of the individual kits of the different treatments. There was no significant difference ($p>0.05$) in the daily weight gain of the different treatment groups.

No still birth was recorded in all the treatments. Diet 4 recorded the highest mortality (44.40%) while diet 2 recorded the least (8.30%). However, there was no regular trend in the mortalities of the different diets.

In conclusion, lysine caused significant improvement of forage intake of does which in-turn resulted n improvement of litter birth weight and litter weight at weaning. It is recommended that lysine supplementation in rabbit diets and the total dietary lysine should not exceed 0.20 and 1.01%, respectively. This level of supplementation and the total dietary lysine appear to be optimal for this species of rabbit especially under a tropical condition.

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