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Reproductive Performance of Rabbits Fed Graded Levels of Methionine in a Tropical Environment

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Abstract: Five graded levels of dietary methionine supplementation were compared in an isonitrogenous (16.87%CP) and isocaloric (2564.84 kcal kg^{-1}) diets fed twenty (20) matured female rabbits (mixed breed) with mean weight range of 1875g and 1893g. The trial lasted 11 weeks (77 days). The rabbits were randomly allocated to the five dietary treatments in a Completely Randomized Design (CRD). Each treatment was replicated four times with one rabbit per replicate. All the parameters considered were significantly influenced ($p<0.05$) except the average litter weight at birth. The mean number of matings (1.0 to 2.0) to conception and gestation length followed no discemible pattern. However, premature litters were produced by rabbits fed diet 5. Mean litter size at birth and mean litter weight respectively ranged from 3.17 to 6.00 and 214g to 29lg and followed no definite pattern. Heavier birth weights were obtained in all the diets (1-4) only with the exception of rabbits fed diet 5. The mean litter size at weaning also rose from D_1 to D_4 only with an exception to rabbits fed Diet 5. The best mean litter weight at weaning was obtained from rabbits fed diet 4. Methionine supplementation at 0.3% therefore, produced a better kit weaning weight, an indication that total dietary methionine content should not exceed 0.61% under a tropical condition. 100% mortality of kits was obtained in rabbits fed D5, an indication that 0.71 dietary methionine content is deleterious to the survival of rabbits.

Key words: Reproductive performance, methionine, tropical environment

INTRODUCTION

Rabbit diet has been found to be relatively low in nutritional value since it is high in indigestible material. Bacterial protein synthesis in the caecum has been demonstrated, but this protein, obtained by means of coprophagy, apparently does not make a large contribution to the essential amino acid needs of the young rabbit. Although the rabbit can adapt to low and poor protein situations, production may not be optimum. However, with high level of good quality protein, optimum production can be achieved[1].

Methionine is the first limiting amino acid in diets formulated from maize meal and Soyabean meal[2]. It's deficiency retarded growth, while over supply became toxic to the animal which also resulted in poor growth[3]. D'mellow and Lewis[4], Clemens and Pain[5], Millward *et al.*,[6] and Kino and Okumura[7] observed that the overall rate of protein synthesis in many types of animal cells is sensitive to amino acid supply. According to them, the efficiency of protein utilization is decreased when there is imbalance of amino acids in protein, hence, the need to ensure the balance for amino acid composition of animals' diets in order to enhance the utilization of proteins.

Oyeyemi *et al.*,[8] stated that does on high nutritional plane had higher number of successful kiddings, relatively shorter gestation periods and heavier kids. They further observed that the various responses of rabbits to different protein supplements are largely a consequence of their amino acid composition. Lebas *et al.*,[9] observed that young growing rabbits need feed that contains certain amounts of 10 of the 21 amino acids that make up proteins, among which is methionine. It was further observed[10] that rabbits will always eat more of a balanced diet containing essential amino acids than the same feed without these amino acids.

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

MATERIALS AND METHODS

Five (5) isonitrogenous (16.87%CP) and isocaloric [2564.84 kcal kg^{-1}) rations were formulated and

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Table 1: Percent. Composition of Diets Containing Graded Levels of Methionine 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 grain	19.25	19.20	19.15	19.10	19.05
Palmkernel meal	19.25	10.20	19.15	1910	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 Min Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.00	0.10	0.20	0.30	0.40
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis:					
%Methionine (without supplement)	0.34	0.31	0.31	0.31	0.31
%Methionine (with supplement)	0.31	0.41	0.51	0.61	0.71
%Lysine (without supplement)	0.81	0.81	0.81	0.81	0.81
% Crude protein	16.87	16.87	16.87	16.87	16.87
Metabolizable energy (Kcal./kg)	2564.84	2564.84	2564.84	2564.84	2564.84

2.5kg per tonne (Vita diz Bcp): Vit. A. 10,000,000I.U., Vit D3. 2000,000I.U, Vit e. 2000IU; Vit. K. 2250mgr. Vit. E. 20000IU; Vit. K. 2250mgr, Themine B1. 1750mgr; Riboflavin B2 mgr; Pyridoxine. B6.270mgr; Niacin, 27500mgr. Vit B12. 15mgr, Pantothenic acid, 7500mgr; Folic acid. 7500 mgr, biotin 50mgr, Chlorine chloride, 400gr; Antioxidant, 125gr, Manganese, 80gr, Zinc 50gr, Iron, 20gr; Copper 5gr; Iodine, 1.2gr; Selenium, 200mgr, Cobalt, 200mgr

supplemented with varying levels of methionine. Diets 1 to 5 were supplemented with 0.00,0.10, 0.20, 0.30 and 0.40% methionine. The percent calculated dietary methionine (before supplementation) For all the diets was 0.31 while it ranged from 0.31 to 0.71 after supplementation. Maize and soyabean meal constituted the major energy and protein sources, respectively.

Experimental animals, management and design twenty (20) matured female rabbits (mixed breed) with mean weight range of 1875g and 1893g were used for the trial. Each rabbit was placed in a separate hutch compartment measuring 75cm x 60cm (floor dimension) with a height of 45cm. The floors were made of wire mesh. They were randomly allocated to the five dietary treatments in a Completely Randomized Design (CRD). Each treatment was replicated four times with one rabbit per replicate. At the commencement of the trial, all animals were weighed. Prophylactic treatment against helminth infestation was done using Embazine Forte ® and Ivomec ®. Equilibration of animals lasted 14 days, during which the test diets were fed preparatory to mating, to physiologically adjust the rabbits to the diets. Mating was done on the 15th day. Animals were fed and watered ad-libitum during equilibration, gestation and for four (4) weeks post kindling. 200g of diet was weighed and fed to each rabbit daily in feeding troughs. Similarly, fresh succulent forages were harvested each day and fed fresh. One kilogramme of succulents was chopped and placed in the hutches each day. The experiment lasted 77 days (11 weeks).

Data Collection

Reproductive parameters: Gestation length for each doe was calculated from day of mating to day of kindling. On day of kindling, gloved hand was used to pick the kits (of one litter) from the kindling box and placed in weighing scales pan to determine litter weight at birth. Similarly, litter members were weighed on day 28-post-kindling to determine final litter weight at weaning. Litter size at birth was done by counting the number of kits per litter while taking litter weight at birth. Total mortality per litter was obtained by deducting litter size at weaning from litter size at birth.

Statistical analysis: All data were subjected to simple descriptive statistics and Analysis of variance was according to the procedures described by steel and Torrie[10]. Treatment means were compared using Duncans New Multiple Range Test[11].

RESULTS AND DISCUSSION

Table 1 shows the percent composition of the experimental diets. The diets were formulated to provide 16.87% crude protein and 2564.84 kcal kg^{-1} metabolizable energy. This is in accordance with, the recommendation of Aduku and Olukosi[12]. The data for the mean gestation length, number of matings prior to conception, litter size at birth, litter weight at weaning, litter weight at birth, litter size at weaning daily litter weight gain and percent mortality per treatment groups are shown in Table 2.

The mean number of matings (1.0 to 2.0) to conception followed no discernible pattern. Though the observed numbers of mating to conception agree with reports of Novy[13], and Odubote and Akinokun[14]. These results could be due to and of the following: amino acid supplementation, faulty sperm transport and/or inhibition

Table 2: Effect of Methionine 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*	1.25^b	2.00^c	0.92^a	0.92^a	1.48^b	1.31	0.223
Av. Gestation Length (days)s)*	31.32^a	30.00^a	30.32^a	30.98^a	29.10^b	30.34	0.578
Litter Size at birth*	3.17^a	6.00^a	5.50^a	3.83^b	6.00^a	4.90	0.833
Av. Litter wt. at birth (g)	223	271	291	241	214	248	36.7
Av. Wt of kit at birth (g)*	65.65^a	45.82^d	52.48^c	61.18^b	36.27^c	52.28	3.149
Av. Litter wt at weaning (g)*	1242^b	1805^a	970^b	1839^a	0.00	1464	199.4
Av.litter size at weaning*	3.33^b	5.00^a	4.00^b	4.00^b	00.00^c	3.27	0.750
Av. Wt of kit at weaning (g)*	384^b	363^b	240^c	480^a	0.00^d	367	88.10
Av. Litter wt. gain at weaning (g)*	708^b	1224^a	367^c	1286^a	0.00^d	896	168.40
Av. Daily wt. gain of litter (g) *	36.4^b	54.8^a	24.2^b	57.0^a	0.00^c	43.1	6.01
Av.Daily wt. gain of individual kit (g)*	11.25^b	10.96^b	6.00^c	14.91^a	0.00^d	10.78	2.103
Percentage mortality of litter *	9.10^c	16.70^c	33.30^b	7.70^c	100.00^a	33.36	9.12

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

of sperm capacitation in the progestational uterus or the presence of active corpora lutea[15]. The gestation lengths were significantly different ($p<0.05$) with rabbits fed diet 5 having the least value (29.10d). The gestation length ranged from 29.10d to 31.32d. They are within the normal range (29-35 days) given in Literature[1,12,15,16], but methionine supplementation seemed not to produce any noticeable pattern of effect on the gestation lengths of the animals. However, premature litters produced under T5 could be attributed to the deleterious effect of excess methionine.Mean litter size at birth obtained was significantly ($p<0.05$) influenced, though, they followed no specific pattern. They ranged from 3.17 to 6.00. The observed result is in consonance with the observation of Lukefahr and Goldman[17], Ohiosimuan *et al.,* [18]and Iyeghe-Erakpotobor *et al.,*[16], which showed a measure of improvement in the litter size when the amino acid profile of their diets was improved. Mean litter weight at birth was not significant ($p>0.05$) and ranged from 214g to 291g. Heavier birth weights were obtained with the exception of Rabbits fed D5. This is in agreement with the finding of Yokogashi and Yoshida[19] that methionine in the diet enhances protein synthesis which in-turn enhanced the litter weight.

The mean litter size at weaning rose from D1 to D4 only with an exception to D5. Rabbits fed D5 died before weaning. The litter size obtained at weaning is comparable to the findings of Iyeghe-Erakpotobor *et al.,*[15] and Ohiosimuan *et al.,*[18]. The best mean litter weight at weaning was obtained from rabbits fed D4. Methionine supplementation at 0.3% therefore, produced a better kit weaning weight which is in agreement with the reports of Egbunike and Ladokun[20] Igwebuike *et al.,*[21] and Ojewola *et al.,*[22]. 100% mortality of Kits was recorded in rabbits fed D5. The high mortality obtained in this trial was not unrelated to methionine toxicity at a level that is too high for the animals.

CONCLUSION

Methionine supplementation at 0.3%, therefore, produced a better Kit weaning weight, indication that total dietary methionine content should not exceed 0.61 under a tropical condition while 0.71 dietary methionine content is deleterious to the survival of rabbits.

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