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Research Article

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Effects of feed supplements on growth and reproductive performances of rabbit

A K M Lutfuzzaman[1], A Arephin[2], and NS Juyena[2*]

[1]District Veterinary Surgeon ((SDPFSP Project)), Sunamganj, DLS, Bangladesh
[2]Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

The study was aimed to investigate the effect of supplementation of concentrate feed on the growth and reproductive performances of Crossbred New Zealand White rabbits does available in some rural areas of Mymensingh district. A total of 20 domestic rabbit does were divided into two groups according to feed supplied and housing system. The reproductive and growth performances of rabbits were recorded before and after treatment. We found that the initial live weight of the rabbit was 1010.75 ± 12.44g. At the end of the experiment, the final live weight of Does was 1681.94 ± 45.68 g and the total live weight (g) gain of Does was 671.19 ± 33.24 g with a growth rate of 5.59 ± 4.23 g/day. It was found that litter weight at birth was 155.33 ± 4.11g and individual kit weight at weaning was 367.9 ± 11.98g. After concentrate supplementation, body weight increased very significantly ($P < 0.01$) and total live weight gain (911.6 ± 29.15 gm) was higher in rabbit does of Group D1, where concentrate was added with regular feed. It was found that litter weights at birth and weaning were significantly ($P < 0.01$) higher in Group D1 in comparison to that of Group D0 (fed regular homemade diet). Shorter age of the first conception (158.2 ± 1.7 days) and gestation length (29.94 ± 0.9 days) were found in does of Group D1 and marked variation ($P < 0.01$) was existed. Similarly, a significant ($P < 0.05$) difference was observed in litter size at birth and at weaning between the two groups. Moreover, kid mortality (9.83 ± 0.34%) was significantly ($P < 0.01$) lower in Group D1. Results of this study indicate a beneficiary effect of supplementation of concentrate into regular diets for does used for breeding purposes.

Keywords: Feed, growth, reproduction, Rabbit

INTRODUCTION

Bangladesh is an agricultural country where livestock plays an important role in its national economy. In Bangladesh, meat produced by different conventional sources like poultry, cattle, sheep and goat is quite insufficient to meet-up the growing demand for animal protein. Therefore, it is necessary to explore some other unconventional sources of animal protein to mitigate protein shortage for the trimming millions. Rabbit, which has been recognized as micro livestock (Vietmeyer, 1985) may be a promising source of protein in Bangladesh. Livestock, whether large or small, is part of the social and cultural reality of several small farmers. FAO (1987) stated that the rearing of rabbits has economic importance in developing countries mainly for meat production. Simple biological characteristics, short breeding cycle, high prolificacy and better feed conversion efficiency logically place rabbits just below poultry. The environment, climatic condition, religious issue and social system are favourable to rabbit rearing in Bangladesh. Rabbits have been started rearing in rural Bangladesh without having minimum knowledge of proper feeding, nutrition and reproduction care. Rab-

*Corresponding author's E-mail address: juyenahabib@yahoo.com

bit meat contains low-fat cholesterol (Jones, 1990). The skin of rabbits may be used in toy, crafts and cottage industries. However, information regarding rearing rabbits under the rural condition with supplementation of concentrate is very limited. Therefore, the study was conducted to explore the growth performances in terms of final live weight, total live weight gain, litter weight at birth and weaning etc., and reproductive performances such as the age of the first conception, gestation period, and litter size at birth and at weaning, and kid mortality in crossbred New Zealand White Rabbit under rural condition.

MATERIALS AND METHODS

The experiment was conducted at farmers homestead in three villages (Mujaty, Lokkhikhula and Nandhi Bari) of Muktagacha Upazilla in Mymensingh district, Bangladesh, with the help of local non-government organization (NGO) Jalal Nagor Development Project.

Twenty domestic Crossbred New Zealand White rabbit does age about 4 to 5 months, weighing between 1000 and 1050 gm were used. The rabbits were divided into two treatment groups i.e. D0 (Conventional diet+ unorganized rabbit house), which was the control group and D1 (Conventional diet + Concentrate feed and + organized rabbit house). The experimental design is shown in Table 1. Careful observation of each rabbit was done to find out any disease problem and to check the mortality throughout the experimental period of 120 days between May and August 2013. The reproductive performances like gestation period, age of the first conception, litter size and kid mortality of the rabbits were recorded in due time.

Housing

In backyard rabbitry, locally available materials are used. The commonly used materials included bamboo, wood, old boxes, mud, bricks, wire net. All of the experimental animals were housed individually in locally made cages measuring about $45 \times 25 \times 55$ cm. The open spaces of the cages or hutches were covered with wire nets to avoid predators like rats, mice, snakes etc. The doors of the houses or cages were made of the bamboo mat, wire net, wooden plank or tin sheet. Each cage was equipped with a nest box at the time of parturition, which provided natural light and ventilation. Some boxes were made of hardboard paper, wooden boxes etc. The feeders and water were kept at the front of each cage and were cleaned regularly in the morning. The faces were taken away to provide proper hygienic conditions in the house.

Feeding

Rabbit Does of control Group (D0) were fed according to farmers own choice, Mander leaves, ful kury grass, kalahuta grass, dhul malik, rice and seasonal vegetables i.e., cabbage, leaf stalk of cauliflower, radish. All rabbits in this group had free access to feed and water. Does of group D1 were fed according to farmers own choice and supplemented with concentrate mixtures such as wheat, gram, maize, wheat bran, common salt, rice bran at the rate of 75 g/day. The required amount of concentrate mixture was supplied twice daily, in the morning (8:00 AM) and afternoon (4:00 PM) by farmers. Clean freshwater was made available to rabbits at all times.

Collection of data

Growth performances: Rabbits were weighed individually by using a weighing balance before starting the experiment and data were recorded as initial live weight (gm). Total live weight (gm) changes were calculated by subtracting the initial weight (gm) from the final weight (gm). Moreover, litter weights (gm) at birth and at weaning were also recorded.

Reproductive performances: Certain parameters were recorded for breeding stock in terms of age at first conception, % of does kid, gestation period, litter size at birth. Following birth, the litter was inspected regularly up to weaning (28 days).

Statistical analysis

Most of the values are presented as Mean$\pm$SEM (standard error mean). Significant differences among the parameters in two treatment groups were identified using ANOVA (analysis of variance) in MSTAT-CRD software. $P < 0.01$ was considered as significant.

RESULTS

The study was aimed to assess the effect of feed on growth and reproductive performances of Crossbred New Zealand White rabbit does. Along with rabbit does, the effect of diet on the growth performance of their kids was studied.

Table 1: Experimental groups

Groups	**Feed**	**Housing system**
D0	Farmers own choose diet (roadside grasses, Surma beni, banana, boiled rice, curry, Mander tree leaves)	Unorganized house-made with locally available bamboo
D1	Farmers own choose diet (roadside grasses, Surma beni, banana, boiled rice, curry, Mander tree leaves) + concentrate mixture (wheat, rice bran, maizes, wheat bran)	Organized house Locally made cages measuring $45 \times 325 \times 55$ cm^3

Table 2: Parameters (Mean±SEM) regarding growth performances of does and kids observed in this study

Parameter	**Mean±SEM**	**Minimum value**	**Maximum value**
Initial live weight (g)	1010.7 ± 12.4	920	1100
Final live weight (g)	1681.9 ± 45.6	1474.5	1892.4
Total live weight gain (g)	671.1 ± 33.2	554.5	792.4
Daily live weight gain (g/day)	5.5 ± 4.2	4.6	6.6g
Litter weight (g) at birth	155.3 ± 4.1	130.7	176.2
Individual kit weight (g) at weaning	367.9 ± 11.9	305	437

Table 3: Effect of feeding concentrate supplement on parameters (Mean±SEM) of growth performance of rabbit does and kids

Parameter	**Treatment**		
	D0	**D1**	**Level of significance**
Initial live weight (g)	1112.07 ± 50.2	969.3 ± 49.3	NS
Final live weight (g)	1482.9 ± 43.4	1880.90 ± 61.2	**
Total live weight gain (g)	370.80 ± 29.9	911.6 ± 29.1	**
Daily live weight gain (g/day)	3.1 ± 3.2	7.6 ± 2.3	
Litter weight (g) at birth	$137.9b \pm 1.7$	172.7 ± 11.07	**
Individual kid weight (g) at weaning	310.60 ± 3.5	408.10 ± 3.8	**

NS = Not significant ($P > 0.05$), ** = Significant at 1% level

D0 = Farmers own diet; D1 = Farmers own diet + Concentrate feed (75 g/day)

Effect of diet on growth performance of rabbit does and kids

The growth performance and live weight changes of rabbit fed *ad-libitum* grasses and with or without concentrate feed are presented in Table 2. These values were considered to record the general range of different growth parameters of rabbit does and kids included in this study. We recorded body weight before starting the experiment and the initial live weight of does was 1010.7 ± 12.4g. At the end of the experiment, the final live weight of the does was 1681.9 ± 45.6g and the total live weight (g) gain of does was 671.1 ± 33.2g with a growth rate of 5.5 ± 4.2 g/day. It was found that litter weight at birth was 155.3 ± 4.1g and individual kid weight at weaning was 367.9 ± 11.9g.

Table 4: Values of reproductive parameters observed in this study

Parameter	**Mean±SE**	**Minimum value**	**Maximum value**
Age of first conception	169.5 ± 2.8	147.5	183.7
Gestation period of Doe (days)	30.5 ± 0.2	29.6	31.4
Litter size at birth	4.6 ± 1.2	3.5	5.8
Litter size at weaning	3.05 ± 0.2	1	5
Kid mortality (%)	20.7 ± 2.6	8.2	38.9

Table 5: Effect of feeding concentrate supplement on reproductive parameters (Mean±SEM) of rabbit does and kids

Parameter	**Treatment**		
	D0	**D1**	**Level of significance**
Age of first conception	182.92 ± 0.87	158.22 ± 1.70	**
Gestation period of Doe (days)	31.21 ± 0.03	29.94 ± 0.09	NS
Litter size at birth	3.59 ± 0.02	5.64 ± 0.03	*
Litter size at weaning	1.37 ± 0.30	2.37 ± 0.27	*
Kid mortality (%)	31.68 ± 1.34	9.83 ± 0.34	**

NS =Not significant (P¿0.05);* Significant at 5% level; ** Significant at 1% level

D0 = Farmers own diet; D1 = Farmers own diet + Concentrate feed (75 g/day)

Effects of feed supplement on the growth performance of rabbit does and kids are presented in Table 3. Before starting the experiment, the bodyweight of all rabbits of two groups was recorded. Although initial live weight was higher in rabbit does of Group D0, variation was insignificant ($P > 0.05$). After concentrate supplementation, body weight increased very significantly ($P < 0.01$) in rabbit does of Group D1. Significantly higher total live weight gain (911.60 ± 29.1 gm) in this group indicates the beneficiary effect of concentrate supplementation for rabbits does use for breeding purposes. It was found that litter weights at birth and weaning were significantly ($P < 0.01$) higher in group D1 in comparison to that of Group D0.

Effect of diets on reproductive performance of rabbit does

The values of the reproductive parameters in rabbit does used in this study are presented in Table 4. The average age of the first conception, gestation period was 169.5 ± 2.7 days and 30.5 ± 0.15, respectively. In addition, mean litter size at birth and weaning were 4.6 ± 1.2 and 3.05 ± 0.2 and 20.7 ± 2.6% kid mortality during this study.

The variations in age of the first conception, gestation period, litter size at birth and weaning and kid mortality% in two groups are shown in Table 5. Considering the feed effect on different reproductive parameters, we observed that the age of the first conception was longer (182.9 ± 0.8 days) in does of Group D0 in comparison to that (158.2 ± 1.7 days) of rabbit does in Group D1 and marked variation ($P < 0.01$) was existed. It is important to mention that all does of D0 and D1 groups gave birth within the study period, i.e. 100% kidding. The average gestation periods were 31.2 and 29.9 days in groups D0 and D1, respectively and varied significantly ($P < 0.05$) with each other. In this study, litter size at birth was significantly ($P < 0.01$) higher (5.6 ± 03) in Group D1. Similarly, a significant ($P < 0.05$) difference was observed in litter size at weaning in Group D1.

DISCUSSION

Rabbit recognized as micro livestock (Vietmeyer, 1985) may be a promising source of protein in

Bangladesh. Therefore, undertaken to investigate the effect of supplementation of concentrate feed on the growth and reproductive performances of Crossbred New Zealand White rabbit does available in some rural areas of Mymensingh district.

Effect of feed on growth performances in rabbit does

The growth performance and live weight changes of rabbits were considered to record the general range of different parameters of rabbit does in this study. It is recorded average initial live weight, final live weight, total live weight gain and growth rate of rabbit does were 1010.7 ± 12.4g, 1681.9 ± 45.6g, 671.1 ± 33.2g, and 5.5 ± 4.2 g/day, respectively. Rafel *et al.* (1996) stated that rabbit does body weight were 1900g. Although initial live weight was higher in rabbit does of group D0, variation was insignificant ($P > 0.05$). After concentrate supplementation body weight increased very significantly ($P < 0.01$) with a significantly higher growth rate (7.6 ± 2.3 g/day) and total live weight gain (911.6 ± 29.1g) in rabbit does of Group D1. We are unaware of similar findings to compare these results. However, Hasanuzzaman *et al.* (2001) have revealed that growth performances are not affected by energy levels. They have also stated that the daily live weight gain of rabbit does could be increased linearly but not significantly ($P < 0.05$) as the increment of metabolic energy level from 2300 to 2700 kcal/kg diet. Increasing dietary protein level from 14 to 16% significantly improves the growth performance carcass weight in New Zealand White growing rabbits (Ahmed *et al.*, 1997). Prasad *et al.* (2000) have stated that viable growth' rate of 25-28 g/d could be obtained on complete diets utilizing locally available concentrate supplements for economic broiler rabbit production. Farinu (1994) found 15.2 g/d weight gain using a compound diet containing 30% soybean meal.

We also studied doe's feed effects on the growth performance of kids up to weaning during the study period. In this study, it was found that litter weights at birth and weaning were significantly ($P < 0.01$) higher in Group D1. Results of this study indicate a beneficiary effect of supplementation of concentrate into regular diets for does used for breeding purposes. Our finding also supports the finding of Abdel (2000) who has stated that body weights at birth and at weaning could be improved with increasing dietary protein levels. In addition, Tawfeek (1996) also reported that restricted or *ad-lihitum* diet supplemented with enzyme improved ($P < 0.05$) litter weight, and body weight at weaning. Yono *et al.* (1986) reported heavier individual kid weight as a result of smaller litter size. But in this study litter size at birth was higher in rabbit does provided with concentrate supplement.

Effect of feed on reproductive performance of rabbit does

We considered the age of the first conception, gestation period, litter size at and weaning and kid mortality as reproductive performances. The age of the first conception was recorded at 169.5 ± 2.7 days with a range of 147.5-183.7 days. This result is in consistent with that reported by Choudhary *et al.* (2001) who have reported the age of the first conception as 241.2 ± 2.9 days. Considering the feed effect, it was observed that the age of the first conception was longer in Rabbit does of Group D0 and marked variation ($P < 0.01$) was existed. Generally, the age at which sexual maturity is reached depends on the size and the breed. In this experiment, the percentage of does kidded is 100%. The average gestation period was 30.58 ± 0.152 (29.5-31.40) days. The present gestation period of rabbits is in close agreement with those reported by Yono *et al.* (1986) and Ehiobu *et al.* (1997) who found that the gestation period of New Zealand White rabbits was 31.8 ± 0.11 days. In this study, the gestation periods varied significantly ($P < 0.05$) between D0 (31.2 days) and D1 (29.9 days). Omar et al. (1997) stated that conceived does showed the shortest gestation length and lowest feed intake when fed 2500 kcal DE/kg and 17% CP with 147.1 1 calorie: protein (C/P) ratio.

It was observed that average litter sizes at birth and at weaning litter size at birth, were 4.6 ± 0.2 and 1.8 ± 0.2, respectively in this study. This result is in contrast with that reported by Rafel *et al.* (1996). They found that litters size at birth and weaning were 8 and 7.2 respectively. Choudhary *et al.* (2001) reported that litter size at birth and weaning were 5.6 ± 0.12 and 4.30 ± 0.13. Whereas Ehiobu *et al.* (1997) reported that the mean litter size at birth and at weaning were 4.400 ± 0.15, and 3.10 ± 0.18, respectively.

In this study that litter size at birth and weaning was affected by different groups of feeding, which was 3.5 ± 0.02 in D0 and 5.6 ± 0.03 in D1. On the contrary, Hasanat (2002) has found that mean litter size at birth and weaning were 2.5 ± 0.2 and 1.3 ± 0.3, respectively. Herbert (1998) stated that litter size at birth and weaning was not affected by different groups of feeding. Ehiobu *et al.* (1997) stated that concentrate supplements in the

diet might not have any influence upon prolificacy and gestation period. On the other hand, Hemid *et al.* (1988) showed that a 17.5% protein diet gave larger litter size, lower mortality and increased number of parities by reducing gestation length and kidding intervals compared with a 15% protein diet.

We observed that kid mortality was 20.7-2.5% with 8.20- 38.8% and kid mortality was significantly ($P < 0.01$) lower (9.8 ± 0.34) in Group D1. Yono *et al.* (1986) also reported less mortality of kits on a low protein diet (17.5% CP). Litter size mostly depends upon the number of ova production i.e., ovulation rate and also due to embryo mortality before birth. Mortality is partly due to the viability of the embryos and partly due to farmers' bad management system and their irresponsibility's. Moreover, higher kid mortality ($31.6 \pm 1.34\%$) was found in the control (D0) group, which indicate the necessity of an improved diet and organized housing system for rabbit farms.

CONCLUSIONS

This study reveals that supplementation of concentrate with a regular diet can improve both growth and reproductive performance. In this study, specific energy levels of feed and their effects on growth and reproductive performance have not been analyzed. However, further study should be directed to find out the energy level of feed and their specific effects on the reproductive performance of crossbred. However, the present investigation could help to increase awareness of Veterinarians as well farmers about feed effects and to design feed for commercial rabbit farms.

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