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Effect of Feeding Different Energy Level Feeds on Litter Growth Performance of Rabbits in Three Successive Kindlings

KEYWORDS: Energy level, litter growth, rabbits, kindlings.

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ABSTRACT *The present study was under taken to study the effect of feeding different energy level feeds on the litter growth performance in rabbits in three successive kindlings at the Small Animal House, Veterinary College, Bangalore. Twelve adult females of second kindling stage and three male rabbits aged between 8 and 9 months with average weight of 2500–2650 g were randomly allotted to three different treatment groups of four animals in each group, namely, Control, T1 and T2 in a completely randomized design (CRD). Rabbits in control group were fed ad lib quantity (2500 Kcal of digestible energy/Kg) and second treatment (T1) group with 2250 Kcal of digestible energy/Kg of diet by restricting 10 % of feed and the treatment (T2) group with 2000 Kcal of digestible energy/Kg of diet restricting 20 % of feed offered than control. The study concluded that high energy diet has an influence on kindling, increases litter size at birth and at weaning, and reduces the age of weaning of bunnies from 42 to 30 days. Bunnies attained a body weight of 400g at weaning. Hence, high energy diet is recommended to obtain good kindling performance in rabbits, which in turn which will increase in economic returns by producing more number of young ones and making rabbitary a highly profitable enterprise.*

INTRODUCTION

In the last two decades, rabbit production has become part of intensive system. Broiler rabbit has the potential to improve food security and play a role in the food requirement to the human population and they are described as 'micro livestock' (Viet Meyer, 1985). With minimum inputs, high quality animal protein can be obtained in rabbit production. Rabbit has the ability to convert feed ingredients into healthy and nutritious meat and also has many advantageous attributes like rapid rate of growth, good reproductive efficiency and short generation intervals, which make rabbit an ideal meat animal. Rabbits can be raised successfully in a backyard rearing system for meat for the family, small surplus for sale or as a large scale commercial enterprise (Gulyani and Karim, 2008). Energy is most required for growing and lactating does. A deficiency of energy during growth will result in stunted growth, low live weight gain and poor feed conversion efficiency. Deficiency of energy in lactating does leads to ketosis, where the mobilization of body energy reserves to milk results in loss of body weight and less milk production (Anil Kumar, 2007). Not much research work has been done in tropical countries like India, to determine the energy requirement for pregnancy, lactation and kindling performance of rabbits. Therefore, keeping above points in view, the present study was under taken to study the effect of feeding different energy level feeds on the litter growth performance in rabbits in three successive kindlings.

MATERIALS AND METHODS

An investigation was carried out to evaluate the effect of feeding different energy levels on kindling performance in rabbits at the Small Animal House, Department o f Livestock Production and Management, Veterinary College, Bangalore.

Twelve adult females of second kindling stage and three male rabbits aged between 8 and 9 months with average weight of 2500–2650 g were randomly allotted to three different treatment groups of four animals in each group, namely, Control, T1 and T2 in a completely randomized design (CRD). The bucks from same line were selected for breeding to avoid genetic contamination. The total duration of the experiment was seven months. The animals were kept for acclimatization to mash feed for two weeks. Rabbits were housed in individual cages of 15 × 18 × 11 inch size. Each rabbit had free access to clean water provided in water. All the experimental rabbits were provided with clean water made available along with dietary treatment every day throughout the experimental period

Treatment Diet Energy level (Kcal/Kg diet fed *ad lib)*

Control diet : 2500 (NRC 1977)

T1 : Low energy diet 2250 (10% feed restriction)

T2 : Low energy diet 2000 (20% feed restriction)

A known weighed quantity of feed was fed *ad lib* to treatment 1 rabbits, and the feed left over was collect-

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ed separately daily and calculated at end of week. According to feed intake of rabbits during previous week, feed to be offered during next week was adjusted by restricting 10 and 20% of feed to the treatment groups T1 and T2 than control respectively.

Litter size and litter weight at birth, litter size and litter weight at weaning, weekly body weight gain and feed consumption were recorded. Weekly body weight gain and feed consumption of three kindlings were analyzed by Analysis of Variance with animal and treatment as main effects using GraphPad Prism version 5.1.

RESULTS AND DISCUSSION

Litter size and litter weight at birth

Average litter size at birth and average litter weight at birth in three kindlings presented in Table 1 and 2. The results revealed significant difference (P<0.05) in litter size at birth in T2 group compared to control group in all the three kindlings fed with three different energy levels. No significant difference (P<0.05) was observed in T1 group when compared with control group.

Table 1: Average litter size at birth and weaning in three kindlings (Mean±SE).

Energy level	First kindling		Second kindling		Third kindling		Total	
	At birth	At weaning	At birth	At weaning	At birth	At weaning	At birth	At weaning
Control	5± 0.62	4± 0.25	5± 0.75	4.5± 0.64	4.5± 0.28	4± 0.40	5^{a}± 0.32	4.25±0.25^{a}
T1	4± 0.62	3± 0.25	3.5± 0.64	3± 0.25	4± 0.81	3± 0.47	4^{b}± 0.37	3±0.19^{b}
T2	4± 0.85	2± 0.85	4± 0.47	2± 0.70	3.5± 0.25	2± 0.62	3.5^{b}±0.31	2±0.38^{c}
Total	53	39	50	37	47	34	150	110

Note: N=12, Mean values bearing different superscripts differ significantly (P< 0.05)

Table 2: Average litter weights at birth and weaning in three kindlings (Mean±SE)

Energy level	First kindling		Second kindling		Third kindling		Total	
	At birth	At weaning	At birth	At weaning	At birth	At weaning	At birth	At weaning
Control	49± 4.24	395± 28.14	45± 3.67	441± 25.07	48± 1.23	427± 14.76	47± 3.04	421±22.65^{a}
T1	49.5 ±2.78	374± 27.82	49± 3.02	393± 30.94	44± 1.55	420± 14.05	47± 2.45	396±24.27^{a}
T2	42.5 ±4.21	315± 26.85	42± 3.03	289± 27.41	35± 1.00	279± 16.90	40± 2.74	295±24.26^{b}

Note: N=4, mean values bearing different superscripts differ significantly (P< 0.05)

Average litter size at birth was significant (P<0.05) in treatment groups compared to control group, containing 2500 Kcal/Kg D.E which has highest litter size. It indicates higher energy favorable to litter size. Similar results were reported by Ren *et al.* (2004) that the group receiving 13.1 MJ DE/Kg (3130 Kcal/Kg) and 17.24% CP (high energy and medium protein) has highest litters at birth amongst 127 litters.

Bonanno *et al.* (2004) reported highest litter size at birth was found by feeding 2800 Kcal/Kg and 2676 Kcal/Kg DE and 19% protein to rabbits. Further Hasanan *et al.* (2006) found that the supplementation of conventional feed along with concentrates reveled litter weight at birth was better and he reported significant difference (P<0.005) in litter size at birth fed with 2700 Kcal ME/Kg. This is in contrast with results of the present study where 2500 Kcal DE/Kg revealed highest litter size at birth. This is due to feeding of high energy diet. In contrast, Roy *et al.* (2002) found significant difference in litter size at birth with 2600 Kcal/Kg DE of energy feeding, since litter size mostly depends upon the ovulation rate (Number of ova shed from ovary at a time) but is not affected by the diet.

Litter size and litter weight at weaning:

The results of average litter size and litter weight at weaning presented in Table 1 and 2. The average litter sizes at weaning were 4, 3 and 2 in Control, T1 and T2, respectively. The highest litter size at weaning was recorded in the Control group with 2500 Kcal DE/Kg diet. There was significant difference (P<0.05) in litter size at weaning in Control group compared to T2 group which received 2000 Kcal DE/Kg and also significance difference (P<0.05) between Control group compared to T1 group which received 2250 Kcal DE/Kg. Average litter weight at weaning in three kindlings was 421±22.65, 396±24.27 and 295 ± 24.26 in Control, T1 and T2 groups respectively. Weaning weights of T2 group were significantly different (P<0.05) compared to control group. No significant difference (P<0.05) between Control group and T1 groups was observed.

Higher litter size at weaning were also noticed by Salma *et al.* (2004) and Hasanan *et al.* (2006) with energy levels of 2700 Kcal DE/Kg and 2500 Kcal DE/Kg. This is due to feeding of high energy diet. The results are also agreeable with the findings of Quevedo *et al.* (2005) that high energy diet favours litter size and litter weight at weaning as energy level of 2500 Kcal DE/Kg help the does to produce more milk. Further, Quevedo *et al.* (2005) attributed this greater maternal aptitude to take care of the young ones. However in contrast to the present study, Roy *et al.* (2002) and Iyeghe-Erakpotobor *et al.* (2008) reported that energy levels did not have any effects on litter size and litter weight at weaning

Weekly body weight gains of bunnies and does

The average weekly body weights and average daily weight gain of bunnies up to weaning in three kindlings is depicted in Table 3.The average body weight changes in does is presented in Table 4.

Table 3: Average weekly body weights and average daily weight gain of bunnies up to weaning in three kindlings. (Mean±SE)

Weeks	Control		T1		T2	
	Weekly weights	ADG	Weekly weights	ADG	Weekly weights	ADG
Birth weight	47± 2.09	--	48± 1.55	--	40± 1.90	--
1st week	119± 5.61	11± 0.50^{a}	126± 4.66	11± 0.44^{a}	98± 18.53	8± 2.37^{b}
2nd week	217± 7.60	14± 0.28^{a}	219± 7.23	13± 0.36^{a}	170± 31.77	10± 1.89^{b}
3rd week	309± 10.55	13± 0.42^{a}	322± 14.81	15± 1.08^{a}	240± 45.38	10± 1.94^{b}
4th week ±SE (weaning weight)	421± 22.65^{a}	16± 1.72^{a}	396± 24.27^{a}	11± 1.35^{b}	295± 33.5^{b}	8± 8.30^{c}
Mean±SE	-	13.5± 0.51	--	13.2± 0.58	--	9± 3.73

Note: N=12, mean values bearing different superscripts differ significantly (P< 0.05)

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Table 4. Average body weight (grams) changes and average daily feed intake (grams) (DMI basis) of does in three kindlings.

Weeks	kindling	Control		T1		T2	
		Weight	Intake	Weight	Intake	Weight	Intake
1	First kindling	2312±175.10	100±0.81	2566±68.84	89.50±0.40	2442±90.12	78.77±0.64
2		2411±160.57	102±0.40	2621±73.31	91.21±0.36	2511±92.35	81.02±0.34
3	Breeding does	2490±180.00	104±0.70	2710±77.91	92.92±0.21	2575±96.87	83.42±0.41
4		2616±180.58	106.5±0.95	2856±96.73	95.60±0.43	2702±93.18	84.93±0.21
5		2731±188.05	102.5±0.64	2937±86.20	91.87±0.62	2835±92.43	81.92±0.25
6		2845±183.33	99.5±1.19	3000±94.32	90.87±0.37	3044±105.78	78.87±0.31
7	kindling	2754±143.70	107.5±0.64	2928±31.66	96.50±0.54	2930±46.38	85.75±0.32
8		2790±149.07	102.25±0.62	2999±36.25	91.87±0.74	2872±22.19	82.00±0.35
9		2825±147.73	103.75±0.75	2993±62.45	92.62±0.37	2884±28.78	83.00±0.20
10		2887±157.61	105.0±0.57	3018±41.36	93.62±0.37	3011±15.02	82.50±0.28
1	Second kindling	2691±68.77	105.0±2.12	2806±20.54	94.37±0.51	2766±23.39	83.75±0.25
2		2773±56.03	106.25±1.93	2863±20.25	95.12±0.23	2855±19.91	84.80±0.33
3	Breeding does	2893±47.91	105.50±1.55	2960±17.99	94.87±0.23	2954±18.67	83.87±0.51
4		3050±61.76	111.00±3.10	3090±33.38	98.62±0.31	3090±14.15	87.62±0.42
5		3196±53.42	100.00±0.91	3207±39.03	89.87±0.31	3194±21.88	79.87±0.12
6		3311±43.41	106.25±0.85	3151±76.92	95.62±0.42	3168±69.46	84.75±0.66
7	kindling	246±111.74	111.50±2.25	2940±47.98	98.62±0.31	3006±31.33	88.12±0.12
8		3057±42.72	114.25±1.93	2917±15.74	102.12±0.42	3013±34.12	92.75±0.32
9		3033±53.20	112.00±3.02	2945±11.44	99.25±0.43	3035±53.00	88.62±0.23
10		3070±59.40	113.50±3.22	3003±5.40	101.25±0.25	3066±45.94	89.62±0.68
1	Third kindling	2872±42.74	106.25±1.18	2867±21.95	95.02±0.36	2918±12.58	84.37±0.23
2	Breeding does	2932±44.89	108.00±1.22	2938±28.44	96.92±0.14	2988±29.37	85.75±0.59
3		3008±45.23	110.25±0.94	3036±34.32	99.37±0.62	3060±35.96	88.37±0.65
4		3123±39.59	112.50±2.32	3200±35.81	99.25±0.43	3194±50.70	88.62±0.23
5		3249±25.22	101.75±1.65	3334±40.25	91.45±0.36	3311±52.086	82.00±0.35
6	kindling	3367±45.48	105.75±1.65	3261±56.50	95.35±0.23	3096±53.013	85.25±0.52
7		3223±109.41	111.00±1.77	3172±47.13	98.62±0.31	3080±39.56	88.12±0.12
8		3097±58.42	114.50±1.25	3182±71.17	102.12±0.42	3127±34.80	92.75±0.32
9		3119±53.45	118.50±2.10	3218±69.51	106.37±0.47	3153±35.79	93.87±0.31
10		3157±46.29	120.75±2.42	3257±62.22	107.75±0.62	3206±39.02	96.87±0.37
Mean±SE			108±0.99[a]		96±0.84[b]		86±0.81[c]

Note: The values bearing different superscripts differ significantly (P< 0.05)

There was no significant (P<0.05) difference between Control & T1 groups whereas significant difference (P<0.05) was observed between Control & T2 and T1 & T2 groups. This showed that the highest weekly body gain was obtained in control group which received 2500 Kcal/Kg DE of energy. This is in agreement with the earlier reports of Roy *et al*. (2002) and Eshiett *et al*. (1979).

The rabbits in all the three treatment groups gained body weight, but the differences between the three groups were not significant (P<0.05). The weight gains of all the experimental groups in the present study were indicative of positive energy balance and after kindling the rabbits showed negative energy balance at 5th, 6th and 7th week, because body energy reserves was converted for milk production. Roy *et al*. (2002) reported as the experimental period progressed, the body weights in general increased. The difference in the body weights may be due to variations in their genotypes but not from feed. Quevedo *et al*. (2005) reported body condition of does increased in the successive weeks of reproductive cycles fed with high energy diet due to greater amount of feed intake.

Contrast results to present study was reported by Catherine and Butcher (1981) that low energy has better affect on growth because rabbits consumed more feed of low energy content. Bonanno *et al*. (2004) in their study

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with 19.2% CP and 2686 Kcal/Kg revealed that there was an improvement in body weight in lactating does till the weaning.

Feed consumption

The results of average feed intake of does during all the kindlings are presented in Table 4. The present experimental study was conducted by restricted feeding to treatment groups to know the effects of energy in different groups. Daily ration of rabbits under intensive rearing does includes concentrate mixture. Lall *et al*. (1984) and Singh *et al*. (1985) reported that under intensive system of rearing feed intake of the rabbits to meet the nutrient requirements, there was significant ($P<0.05$) difference in the feed intake among the groups.

The feed intake is limited by the energy, fibre and total digestible nutrient of the diet and it was found that rabbits consumed more feed with low energy diet (77.61g/day) compared to the high energy diet (67.87g/day) and standard diet (control diet) (71.88g/day). The average body weight gain of three treatment groups were comparable to the body weight gain reported by Prasad *et al*. (1996) and Meena (1998) in broiler rabbits fed standard diets. Bonanno *et al*. (2004) reported slight improvement in the Litter size, Litter weight and growth performance of bunnies with restricted feeding. Whereas females showed superior productivity in terms of litter size and litter weight at weaning might be due to the longer reproductive period, higher fertility rate, higher litter size and higher number of viable bunnies.

CONCLUSION

It can be concluded from present study that high energy diet has an influence on kindling, increases litter size at birth and at weaning, and reduces the age of weaning of bunnies from 42 to 30 days. Bunnies attained a body weight of 400g at weaning. Hence 5-6 kindlings can be achieved in a year. The overall high energy feed influences the reproductive parameters like growth, kindling, lactation and survivability. Hence, high energy diet containing 2500 Kcal of DE/Kg is recommended to obtain good kindling performance in rabbits, which in turn which will increase in economic returns by producing more number of young ones and making rabbitary a highly profitable enterprise.

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