Original Research

Study on Pre-Weaning Growth Performance of Broiler Rabbits

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Abstract

Data recorded on growth of 433 bunnies born in to 112 litters of two synthetic rabbit genetic groups APAU Fawn (FN) and APAU Black (BL), from August 2011 to September 2012, of Rabbit Research Centre, College of Veterinary Science, Hyderabad, were utilized for the present investigation to evaluate influence of genetic and non-genetic factors on pre weaning growth performance of the two breeds under study. The effect of genetic group was significant limited to a particular period of study. Season of birth exerted highly significant influence on body weight gained, with winter proving to be the promising period for growth. Litter size at birth was found to exert influence on body weight gained by each bunny in a group, with smaller groups gaining more. Genetic group, Season of birth and Litter size exerted a significant influence on Average Daily Gain (ADG) of bunnies. The overall pre-weaning mean body weight at first and fourth week ranged from 51.30 ± 0.38g to 476.39 ± 5.43g, respectively, whereas the ADG ranged from 8.86 ± 0.15g to 29.52 ± 0.73 g, for the same period.

Key words: Average Daily Gain, Body Weight, Rabbit, Pre-Weaning

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Introduction

Of late, there has been an increased awareness of the advantages of rabbit meat production in developing countries as a means to alleviate food shortages. This is largely attributable to the rabbit's high rate of reproduction; early maturity; rapid growth rate; high genetic selection potential; efficient feed and land

space utilization; limited competition with humans for similar foods and high-quality nutritious meat Cheeke (1980). The rabbit has been used as an experimental animal in genetics and reproductive physiology since long, but it was not until 1950 that the first findings on quantitative genetics were published, Venge (1950). This work paved the way for research on the genetic improvement of the rabbit for meat production. For the past few decades, extensive work has been carried out on rabbits throughout the World and India in particular. Emphasis was laid on establishing the genetic worth of each individual breed reared at different geographical regions. However, sometimes a group of rabbits available in a particular geographical region have certain distinct characteristic features that enable them to be differentiated from other genetic groups. The characteristic features of these groups need to be studied on the basis of their physical, physiological, reproductive, productive and genetic parameters.

Two synthetic genetic groups, namely APAU-Fawn and APAU-Black, were evolved from Grey Giant and New Zealand White in F_2 and further generations at "Rabbit Research Centre", Hyderabad. Selective breeding within breeds was carried out for breed stabilization and to exploit within breed genetic variation for economic traits in rabbits. Jaya Laxmi *et al.* (2009), carried out a preliminary work comparing the performance of FN rabbits with other established breeds of rabbit. Later on not much work was carried out exclusively on these two breeds to establish its genetic worth. The present study aims at evaluating genetic and non-genetic factors influencing growth traits of the above mentioned genetic groups.

Materials and Methods

The synthetic rabbit breeds APAU Fawn and APAU Black maintained at Rabbit Research Centre, Department of Animal Genetics and Breeding, College of Veterinary Science, Hyderabad were reared under uniform environmental conditions with proper ventilation and a temperature range of 28-30°C. About 100-150 g of concentrate mixture with a composition of 50% Maize, 22% GNC, 25% wheat bran and 3% mineral mixture was fed daily and supplemented with Alfalfa green fodder. Clean drinking water was provided throughout the day using nipple drop system. Body weights were recorded for each individual at 0 day and every weekly interval up to 4 weeks of age.

Statistical Analysis

Data generated for growth trait was subjected to least squares analysis using Proc (Procedure) GLM (General Linear Model) of SPSS (Statistical Package for Social Sciences) 15.0 and the data were corrected for significant non-genetic effects (season of birth). Litter size was divided in to three groups. The first group includes litter bearing 2 to 4 kits, second group 5 to 7 kits and third group 8 to10 kits. Season of birth were divide as winter (November to February), summer (March to June) and rainy (July to October).

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Results and Discussion

Pre-Weaning Body Weight

The results obtained from least-squares analysis of variance and mean body weights at pre-weaning ages presented in Table 1 & 2.

Table 1: Least-squares analysis of variance for pre-weaning body weights

Source of Variation		Mean Sum of Squares								
	d. f.	BW 0	d. f.	BW 1	d. f.	BW 2	d. f	BW3	d. f	BW4
Genetic group	1	1.27	1	1064.36	1	10928.53**	1	41.98	1	1776.76
Season of birth	2	2643.43**	2	8648.50**	2	45312.79**	2	63082.74**	2	57446.49**
Sex of bunny	1	1368.71**	1	10216.81**	1	19631.65**	1	7663.64**	1	23561.39
Litter size at birth	2	490.61**	2	4954.72**	2	18169.25**	2	32893.49**	2	180956.87**
Error	426	55.29	426	431.75	426	1526.78	426	4210.47	426	11190.76

**Significant (P≤0.05), **Significant (P≤0.01)*

Table 2: Least-squares means for pre-weaning body weight (g)

	n	BW O	n	BW 1	n	BW 2	n	BW 3	n	BW 4
Overall	433	51.30 ± 0.38	433	111.20 ± 1.06	433	178.74 ± 2.00	433	273.75 ± 3.33	433	476.39 ± 5.43
Genetic group										
Fawn	209	51.24 ± 0.53	209	112.79 ± 1.48	209	183.86^{a} ± 2.79	209	273.43 ± 4.46	209	478.45 ± 7.56
Black	224	51.35 ± 0.52	224	109.60 ± 1.46	224	173.61^{b} ± 2.75	224	274.07 ± 4.57	224	474.32 ± 7.46
Season of birth										
Summer	150	49.79^{b} ± 0.62	150	112.49^{b} ± 1.75	150	169.91^{b} ± 3.29	150	263.10^{b} ± 5.46	150	491.54^{a} ± 8.91
Rainy	153	47.67^{c} ± 0.66	153	102.41^{c} ± 1.86	153	165.86^{b} ± 3.51	153	258.78^{b} ± 5.83	153	452.82^{b} ± 9.51
Winter	130	56.43^{a} ± 0.65	130	118.69^{a} ± 1.84	130	200.43^{a} ± 3.46	130	299.37^{a} ± 5.74	130	484.80^{a} ± 9.36
Sex of bunny										
Male	196	49.50^{b} ± 0.55	196	106.27^{b} ± 1.53	196	171.91^{b} ± 2.89	196	269.48^{b} ± 4.80	196	468.90 ± 7.83
Female	237	53.10^{a} ± 0.50	237	116.12^{a} ± 1.40	237	185.56^{a} ± 2.63	237	278.02^{a} ± 4.37	237	483.87 ± 7.13
Litter size at birth										
2-4	137	50.95^{b} ± 0.64	137	117.21^{a} ± 1.81	137	192.40^{a} ± 3.40	137	292.25^{a} ± 5.65	137	506.20^{a} ± 9.21
5-7	208	49.38^{c} ± 0.53	208	105.97^{b} ± 1.48	208	173.37^{b} ± 2.80	208	267.65^{b} ± 4.65	208	439.62^{b} ± 7.58
8-10	88	53.56^{a} ± 0.81	88	110.41^{a} ± 2.28	88	170.43^{b} ± 4.28	88	261.34^{b} ± 7.12	88	483.34^{a} ± 11.60

Means with similar superscripts within each column under each effect do not differ significantly

The genetic group had a significant influence on body weight at 2 weeks of age only, which is in partial agreement with Anitha *et al.* (2009) and Obike *et al.* (2010) who reported influence of genetic group on body weight at all ages of pre-weaning. Statistically Fawn group of rabbit gained more body weight compared to black group over the entire period of study. The overall least-squares mean body weights at birth, 1, 2, 3 and 4 weeks of age were 51.30 ± 0.38, 111.20 ± 1.06, 178.74 ± 2.00, 273.75 ± 3.33 and 476.39 ± 5.43g, respectively, which concurs well with the findings of Devi *et al.* (2007) and Prakash *et al.* (2008) at most of the ages studied, partly in accordance with reports of Lavanya *et al.* (2017) and were higher than the values reported by Udai *et al.* (2017) in Soviet chinchilla and Californian breeds of rabbit . Least-squares mean body weights at birth, 1, 2, 3 weeks and 4 weeks of age were, 51.24 ± 0.53, 112.79 ± 1.48, 183.86 ± 2.79, 273.43 ± 4.46 and 478.45 ± 7.56 g, in FN rabbits and 51.35 ± 0.52, 109.60 ± 1.46, 173.61 ±

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2.75, 274.07 ± 4.57 and 474.32 ± 7.46 g, in BL rabbits, respectively. Season of birth exerted significant influence on body weights as observed in the present investigation with bunnies recording significantly higher body weights compared to other seasons at most of the pre-weaning ages recorded, which concurred well with findings of Abdel-Azeem *et al.* (2007) Anitha *et al.* (2009), Devi *et al.* (2007) and Poornima *et al.* (2002) who also reported higher body weights in winter born bunnies. Least-squares mean body weights at birth, 1, 2, 3 weeks and 4 weeks of age were 56.43 ± 0.65, 118.69 ± 1.84, 200.43 ± 3.46, 299.37 ± 5.74, 484.80 ± 9.36 g, respectively for bunnies during winter and 47.67 ± 0.66, 102.41 ± 1.86, 165.86 ± 3.51, 258.78 ± 5.83 and 452.82 ± 9.51 g, for bunnies born during rainy season. Sex of bunny exerted significant influence on body weights at all pre-weaning ages studied, except at 4th week of age. In concurrence with reports of Lavanya *et al.* (2017) and partly in accordance with Udai *et al.* (2017). Contrary to the findings of Marykutty and Nandakumar (2000) and Abdel-Azeem *et al.* (2007) who observed a non-significant effect of sex on body weights. Females recorded heavier body weights compared to males at all ages of per-weaning period studied.

Litter size at birth had high significant effect on body weight at all ages, which is in agreement with findings of Anitha *et al.* (2009), with bunnies born in to smaller litters recording heavier body weights, due to the fact that the relative share of milk per kit decreased as the litter size increased, which agrees well with a series of findings of Poornima *et al.* (2002), Castellini *et al.* (2003) and Prakash *et al.* (2008), who reported that bunnies born during summer and in to smaller litters recorded heavier pre-weaning body weights.

Average Daily Gain (ADG)

Least-squares analysis for variance and mean ADGs during pre-weaning period are presented in Tables 3 and 4, respectively.

Table 3: Least-squares analysis of variance for pre-weaning ADG

Source of Variation	d. f.	Mean Squares			
		1week	2 week	3week	4week
Genetic group	1	16.73	95.34*	278.48*	21.96
Season of birth	2	78.77**	412.11**	32.44	1941.80**
Sex of bunny	1	107.48**	41.45	35.62	168.83
Litter size at birth	2	101.01**	124.98**	154.99*	1229.00**
Error	425	6.49	16.97	45.33	151.97

**Significant (P≤0.05), **Significant (P≤0.01)*

The effect of genetic group was found to be significant on ADGs at 2 and 3 weeks of age. Which concurs well with the findings of Oke *et al.* (2004), who stated significant differences for ADG among three breeds of rabbits studied, NZW, Dutch and Chinchilla and also with the findings of Anitha *et al.* (2009) in NZW, SC and FG breeds of rabbits. The overall least-squares mean ADGs at 1, 2, 3 and 4 weeks age were 8.86 ± 0.15, 9.88 ± 0.24, 14.00 ± 0.39 and 29.52 ± 0.73 g, and the corresponding means were 9.06 ± 0.19, 10.36

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± 0.31, 13.18 ± 0.51 and 29.75 ± 0.94 g for FN rabbits and 8.66 ± 0.19, 9.40 ± 0.31, 14.82 ± 0.52 and 29.29 ± 0.95 g for BL rabbits, respectively. The FN rabbits recorded higher ADGs compared to BL rabbits, though non-significantly at some periods. These estimates were lower than the mean ADGs reported by Medellin and Lukefahr (2001), Abou-Khadiga *et al*. (2008) and Ouyed *et al*. (2008) and higher than the values reported by Devi *et al*. (2007).

Table 4: Least-squares means for pre-weaning ADG (g)

	N	ADG 1	n	ADG 2	n	ADG 3	N	ADG 4
Overall	433	8.86 ± 0.15	433	9.88±0.24	433	14.00±0.39	433	29.52±0.73
Genetic group								
Fawn	209	9.06 ± 0.19	209	10.36±0.31	209	13.18±0.51	209	29.75±0.94
Black	224	8.66 ±0.19	224	9.40 ± 0.31	224	14.8 ± 0.52	224	29.29±0.95
Season of birth								
Summer	150	9.38^{a} ± 0.22	150	8.54^{b} ±0.36	150	13.76^{a}±0.59	150	33.79^{a}±1.09
Rainy	153	8.00^{b} ±0.23	153	9.19^{b} ±0.38	153	13.65^{a}±0.62	153	27.68^{b}±1.15
Winter	130	9.21^{a} ± 0.23	130	11.91^{a}±0.38	130	14.58^{a}±0.62	130	27.10^{c}±1.15
Sex of bunny								
Male	195	8.35 ± 0.20	195	9.56 ± 0.32	195	14.29 ±0.52	195	28.89 ±0.96
Female	238	9.37 ±0.19	238	10.19 ±0.31	238	13.70 ±0.50	238	30.16 ±0.92
Litter size at birth								
2-4	62	10.21^{a}±0.32	62	11.26^{a}±0.53	62	15.68^{a}±0.86	62	30.89^{a}±1.58
5-7	284	8.29^{b} ±0.15	284	9.81^{b} ±0.25	284	13.37^{b}±0.41	284	26.12^{b}±0.75
8-10	87	8.09^{b} ±0.28	87	8.56^{b} ±0.45	87	12.95^{b}±0.74	87	31.57^{a}±1.36

Means with similar superscripts within each column under each effect do not differ significantly

Influence of season of birth was found to be highly significant on ADGs at all ages, except at 3 weeks age in accordance with observations of Gupta (1998), EL Maghawry *et al*. (1999) and Anitha *et al*. (2009). Least squares mean ADGs at 1, 2, 3 and 4 week of age were 9.21 ± 0.23, 11.91 ± 0.38, 14.58 ± 0.62 and 27.10 ± 1.15 g, in rabbits born during winter and 9.38 ± 0.22 , 8.54 ± 0.36, 13.76 ± 0.59 and 33.79 ± 1.09 g, in rabbits born during summer respectively. In general, the bunnies born during winter season recorded significantly higher ADGs at most of the ages studied when compared to those born during summer and rainy seasons.

Female recorded higher ADGs compared to male at most of the ages, though non-significantly. Sex of the bunny did not had a significant influence on ADGs at most of the ages except at 1 week of age. Gupta (1998) also observed a non-significant effect of sex on ADG in rabbits. Litter size at birth exerted significant effect on ADGs studied at all ages, in the present investigation and this agrees well with the observations of Gupta (1998), EL Magahwary *et al*. (1999), Borthakur *et al*. (2002), Devi *et al*. (2007) and Anitha *et al*. (2009). However, Prayaga and Eady (2003) observed a non-significant influence of litter size at birth on ADG. Rabbits born in to smaller litters recorded significantly higher AGDs at all ages of pre-weaning period (except at 4 week of age) compared to those born in to medium and larger litters.

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Conclusion

Results of the present study have revealed that the FN rabbits had better performance compared to BL rabbits with respect to the body weights and growth rates at pre-weaning ages. However, a comprehensive study on these two genetic groups would be helpful further in establishing their genetic worth.

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References

1. Abdel-Azeem AS, Abdel-Azim AM, Darwish AA and Omar EM. 2007. Body weight and carcass traits in four pure breeds of rabbits and their crosses under Egyptian environmental conditions. In: The 5th International Congress on Rabbit Production in Hot Climate, Hurghada, Egypt. pp. 67-80.
2. Abou-Khadiga G, Saleh K, Nofal R and Baselga, M. 2008. Evaluation of growth traits in a breeding experiment involving line v and baladi black rabbits in Egypt. In: 9th World Rabbit Congress, Verona, Italy.
3. Anitha K, Gnana Prakash M and Ramesh GB. 2009. Post weaning performance of broiler rabbits. India Journal of Animal Research 43: 246-250.
4. Borthakur, B., Das D, Das GC, Goswami RN and Buzarbarua KM. 2002. Studies on factors affecting post weaning daily body weight gain in New Zealand White rabbit. Indian Veterinary Journal 79 : 30-32.
5. Castellini C, Dal Bosco A and Migani C. 2003. Comparison of different reproduction protocols for rabbit does: effect of litter size and mating interval. Livestock Production Science 83: 131-139.
6. Cheeke PR. 1980. Editorial: The potential role of the rabbit in meeting world food needs. Journal of Applied Rabbit Research 3: 3-5.
7. Devi SVD, Gupta RB, Rao NG and Satyanarayana A. 2007. Genetic study on pre-weaning body weights of soviet chinchilla rabbits. Indian Journal of Animal Research 41: 261-265.
8. EL Magahwary AM, Ahmed SS, Yamani KA and Radwan H. 1999. Some reproductive and productive traits of New Zealand White, Rex Rabbits and their crosses. Egyptian Journal of Rabbit Sciences 9: 159-77.
9. Gupta RB. 1998. Genetic analysis of the performance of crossbred broiler rabbits. Ph.D. Thesis, Acharya N.G. Ranga Agricultural University, Hyderabad.
10. Jaya Laxmi P, Ramesh GB, Gnana Prakash M, Ekambaram B and Amareswari P. 2009. A study on the performance of fryer rabbits under different systems of rearing. Livestock Research for Rural Development 21: Article # 118.
11. Lavanya R, Mahender M, Rajanna N and Gnanaprakash M. 2017. Productive performance of broiler rabbits. Indian Journal of Animal Research 51(2): 391-394.
12. Marykutty T and Nanda kumar P. 2000. Factors influencing litter traits and body weight up to 12 weeks among temperate rabbit breeds in humid tropics. World Rabbit Science 8: 67-70.
13. Medellin MF and Lukefahr SD. 2001. Breed and heterotic effects on postweaning traits in Altex and New Zealand White straight bred and crossbred rabbits. Journal of Animal Science 79: 1173-1178.
14. Obike ON, Ibe SN and Oke UK. 2010. Estimation of pre-weaning body weight of rabbits in a humid tropical environment using linear body measurements. American-Eurasian Journal of Agriculture & Environmental Science 9: 440-444.
15. Oke UK, Ibe SN and Ogbonnaya EO. 2004. Effect of Genotype on Growth Traits of Rabbits. International Journal of Agriculture and Rural Development 5: 61-68.

DOI 10.5455/ijlr.20171205103612

16. Ouyed A and Brun JM. 2008. Heterosis, direct and maternal additive effects on rabbit growth and carcass characteristics. 9th World Rabbit Congress, Verona, Italy.
17. Poornima K, Gupta BR, Rao GN and Satyanarayana A. 2002. Genetic study on re-weaning body weights and growth rates in Californian White rabbits. Indian Journal of Animal Sciences 36: 39-42.
18. Gnana Prakash M and Gupta RB. 2008. Pre-weaning performance of broiler rabbits. 2008. Indian Journal of Animal Research 42: 276-278.
19. Prayaga K.C and Eady SJ. 2003. Performance of purebred and crossbred rabbits in Australia: Individual growth and slaughter traits. Australian Journal Agriculture Research 54: 159-166.
20. Uday K, Sai Reddy S, Gnana Prakash M, Mahender M and Amareswari. P. 2017. Performance evaluation of Soviet Chinchilla and Californian White rabbit breeds in tropical climatic conditions of India. Indian Journal of Animal Research. 416-243.
21. Venge Ole. 1950. Studies of the maternal influence on the birth weights in rabbits. Acta. Zoo 31: 1-148.

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