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Performance evaluation of body weight traits of exotic rabbit breeds in an organized farm of Kashmir

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Abstract
Rabbit is a multipurpose animal much valued for meat production of superior quality protein with high biological value. The present study was undertaken on 689 birth records of six exotic breeds born to 55 sires. The data were collected for birth weight, weaning weight and yearling body weight over a period of three years (2009 to 2011) from six different exotic breeds of rabbits (Soviet Chinchilla, Grey Giant, California, French Angora, German Angora, New Zealand White) maintained at Government Angora Rabbit Farm, Wusan- Pattan, District Baramulla, Kashmir. Least squares techniques outlined by [12] were adapted to analyze the data with breed, gender, year and season as fixed effects. The overall least means for birth weight (BWT), weaning weight (WWT) and adult body weight (ABW) were 0.46±0.01, 1.17±0.02 and 3.29±0.07, respectively. The statistical analysis revealed that the effect of year and sex was non-significant whereas the effect of the breed was highly significant (p=0.01) on all the traits under study. The sexual dimorphism was slightly in favor of the female kit with respect to all traits. The effect of season was significant (p>0.05) on BWT and AWT with winter born kits were heavier at all stages. The Soviet Chinchilla breed demonstrated higher body and superiority (p<0.01) with respect to all traits when compared to other breeds. The results indicate that data should be corrected for non-genetic factors while estimating breeding values.

Keywords: Rabbit, least square analysis, performance evaluation

Introduction
Rabbit farming is done for meat, wool, fur, laboratory animal and biological production purposes. Rabbits belong to one of the several species quite suitable for meat production owing to high litter size [1], fast growth rate [2] and production of meat of superior quality protein (20 - 21%) with high biological value in terms of amino acid composition. The rabbit meat is low in calories, sodium and cholesterol [3] whereas rich in unsaturated fatty acids (60% of the total fatty acids [4]. High prolificacy, short gestation length, minimal initial capital outlay and great genetic flexibility add to economic traits of domestic rabbits [3]. Genetic improvement of rabbit is important in order to increase their contribution to animal protein [2]. For the genetic improvement, selection must be based on genetic merits instead of phenotype [4]. Different environmental factors like age of sire or dam, sex of animal, birth type and breed influence the breeding value [5]. Estimation and study of such environmental effects on different traits of economic value and correction of records for the factors result in estimated genetic worth of animal to show its genetic potential [4]. Therefore, the present study was designed to study the effect of breed and non-genetic factors (sex of lamb, year of birth and season of birth) on some growth traits of different exotic managed under organized farm conditions of Kashmir Valley.

Materials and Methods
a. Sample Collection
The data were recorded for birth weight, weaning weight and yearling body weight over a period of three years (2009 to 2011) from six different exotic breeds of rabbits (Soviet Chinchilla, Grey Giant, California, French Angora, German Angora, New Zealand White) maintained at Government Angora Rabbit Farm, Wusan-Pattan, District Baramulla, Kashmir.

Data Analysis

The data were classified to study the effect of breed (6 groups) and non-genetic factors like years (3 groups), gender (Male, Female), and season (four groups). Least squares techniques out lined by [12] were adapted to analyze the data with breed (1 to 6), gender (1 to 2), year (1 to 3) and season (1 to 4) as fixed effects.

The model used for the present study was,

$$Y_{ijklm}=\mu+B_i+Y_j+S_k+G_l+e_{ijklm}$$

where, Y_{ijklm}=Observation of m^{th} lamb of l^{th} sex, born in k^{th} season and i^{th} year of j^{th} genetic group.

The statistical significance of various fixed effects in the least squares model was determined by 'F' test. For significant effects, the differences between pairs of levels of effects of period were subjected to by Duncan's multiple range test (DMRT) as modified by [6] in SPSS Version 20 software.

Results and Discussion

The overall least squares means along with breed effect and effect of non-genetic factors are presented in Table 1. The overall least means for birth weight (BWT), weaning weight (WWT) and adult body weight (ABW) were 0.46±0.01, 1.17±0.02 and 3.29±0.07, respectively. More or less similar estimate of birth weight was obtained by [7] in New Zealand White rabbit. However, lower estimates were reported by [9] in French Angora and German Angora for BWT, WWT and ABW. The statistical analysis revealed that the year effect was non-significant on all the traits under study whereas effect of season was significant (p>0.05) on BWT and AWT. [8] on birth weight in New Zealand White, Soviet Chinchilla and White Giant rabbit breeds also reported non-significant effect of year on pre-weaning growth traits. However, [8] reported a non-significant effect of season on pre-weaning growth traits. The effect of year accounts for management differences whereas the effect of season accounts for variation in weather conditions in terms of temperature, humidity etc. [7] in New Zealand White rabbit also reported significant variation in body weight traits due to season of birth. The winter born kits were heavier at all stages. The finding was in consonance with the report of [10] in Giza White rabbits. The effect of sex was non-significant with sexual dimorphism slightly in favor of female kits with respect to all the traits under study. The effect of breed was highly significant (p>0.01) on all traits under study. The Soviet Chinchilla breed demonstrated higher body and superiority (p<0.01) with respect to all traits when compared to other breeds (Table 1). The result with respect to sex and breed was in consonance with New Zealand White, Soviet Chinchilla and White Giant rabbit breeds.

Conclusion

The study revealed that body weight traits were significantly influenced by breed and season. Therefore, while framing genetic improvement programme of rabbit farming non-genetic factors should be given due weightage and hence data should be corrected for these non-genetic effects while estimating breeding values. Future genetic and nutritional studies are highly recommended for adding further information on successful rabbit farming. The present study will provide bases for genetic manipulation and improvement of rabbits in temperate conditions of Kashmir.

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Table 1: Least squares means for various non-genetic factors influencing body weight traits in different exotic breeds of rabbits.

Particulars	N	BWT (kg)	WWT (Kg)	ABT (Kg)
	689	0.46±0.01	1.17±0.02	3.29±0.07
year	**P. value**	**(0.178)**	**(0.574)**	**(0.689)**
2009	232	0.46^{a}±0.01	1.16^{a}±0.02	3.25^{a}±0.08
2010	393	0.48^{a}±0.01	1.19^{a}±0.02	3.33^{a}±0.07
2011	64	0.45^{a}±0.02	1.18^{a}±0.03	3.29^{a}±0.13
Season	**P. value**	**(0.038)**	**(0.177)**	**(0.091)**
Spring	411	0.44^{a}±0.01	1.17^{a}±0.02	3.30^{a}±0.07
Summer	112	0.46^{a}±0.02	1.18^{a}±0.03	3.38^{a}±0.11
Autumn	87	0.46^{a}±0.02	1.14^{a}±0.03	3.08^{a}±0.12
Winter	79	0.49^{b}±0.02	1.21^{a}±0.03	3.39^{a}±0.12
Breed	**P. value**	**(0.009)**	**(0.000)**	**(0.000)**
Soviet Chinchilla	101	0.50^{b}±0.02	1.27^{b}±0.03	3.88^{c}±0.12
Grey Giant	167	0.45^{ab}±0.02	1.19^{b}±0.03	3.32^{bc}±0.11
California	118	0.45^{ab}±0.02	1.12b±0.03	3.00^{ab}±0.11
French Angora	127	0.46^{ab}±0.02	1.24^{c}±0.03	3.35^{c}±0.11
German Angora	75	0.48^{b}±0.02	1.17^{b}±0.03	3.31^{bc}±0.12
New Zealand White	101	0.42a±0.02	1.06a±0.03	2.90^{a}±0.11
Sex	**P. value**	**(0.167)**	**(0.290)**	**(0.417)**
Male	343	0.45^{a}±0.01	1.17^{a}±0.02	3.26^{a}±0.09
Female	346	0.47^{a}±0.01	1.18^{a}±0.02	3.32^{a}±0.08

Means with different superscripts in the columns differ significantly. NS indicates non-significant. * indicates significant at 5% level. ** indicates significant at 1% level.

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