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INFLUENCE OF MATERNAL FACTORS ON PREWEANING GROWTH AND VIABILITY OF TEMPERATE RABBIT BREEDS

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Considering the tremendous potential of broiler rabbits as an alternate source of meat, they were introduced into the humid tropics of Kerala state. Studies on the performance of broiler rabbits revealed a low litter size at birth (LSB) and a high preweaning mortality (PWM) (Sundaram and Bhattacharya, 1992; Mukundan *et al.*, 1993). The considerable variation on the litter traits and mortality among different breeds necessitate a detailed investigation on the factors influencing these traits. In a study on New Zealand White (NW), Soviet Chinchilla (SS) and Grey Giant (GG), Nandakumar and Thomas (1998) reported significant effect of breed on LSB, while Khalil *et al.* (1995) could find no significant association between breed and LSB in Egyptian tropics. Adult body weights were found to be associated with litter size and litter weights (Bironi *et al.*, 1989). Nemeth *et al.* (1989) observed a significant association between adult body weight (BW), PWM and litter traits of the doe. Significant association between litter weight traits and PWM has been reported by Khalil *et al.* (1986) and Farghaly (1996). Teat number (TN) of the doe was reported to have a significant association with litter traits, growth and PWM among neonates (Lukefahr *et al.*, 1984; Feischhauer *et al.*, 1985; Szendro *et al*, 1992). With this background it was attempted to analyse the association between breed, BW, TN, LSB, litter weight at birth (LWB), litter weight at three weeks (LW3), litter weight at weaning (LWW) and PWM among broiler rabbits.

Materials and methods

A pure breeding experiment was conducted using three broiler breeds of rabbits viz., NW, GG and SS. All animals were maintained under identical conditions of feeding and management. First kindling performance of 81 adult does of six to twelve months of age were studied. BW and TN of the doe were recorded at the beginning of the experiment. LSB, LWB, LW3, LWW (four weeks) and PWM were recorded. The percentages of PWM were subjected to $\sin^{-1}$ transformation. Based on the TN, does were grouped into three classes (8, 9, 10) and based on LSB they were classified into nine groups (1,2,....9).

Least squares analyses (Harvey, 1985) were performed to assess the association of breed, TN of the doe and LSB on the BW, LWB, LW3, LWW and PWM using the statistical model,

$$Y_{ijkl} = m + b_i + t_j + l_k + e_{ijkl}$$

where Y_{ijkl} = observed trait on the doe of i^{th} breed with j^{th} TN and with k^{th} LSB

m = overall mean

b_i = effect of i^{th} breed of doe

t_j = effect of doe with j^{th} TN (8,9,10)

l_k = effect of k^{th} LSB (1,2, ... 9)

e_{ijkl} = random error

Phenotypic correlation between BW, LWB, LW3, LWW and PWM were estimated.

Results and discussion

Least squares analyses of variance for the association of breed, TN and LSB on BW, LWB, LW3, LWW and PWM are documented in Table 1.

Table 1 Least squares analysis of variance for the effect of breed, teat number and litter size at birth on the adult body weight, litter weights at birth, three and four weeks and pre-weaning mortality in broiler rabbits.

Source of variation	df	Adult body weight	Litter weight at birth	Litter weight at three weeks	Utter weight at fourweeks	Preweaning mortality
Breed	2	0.1103	0.0005	0.0647	0.5456	1379.0097
Teat Number	2	0.0927	0.0005	0.0996	0.2737	44.7820
Litter size at birth	8	0.0641	0.0547	0.4961	1.0170	1097.1842

Breed was not found to have any significant association with BW, LWB, LW3, LWW and PWM. TN also had no significant association with BW, LWB, LW3, LWW and PWM. LSB, BW and PWM were not found to be significantly associated. However LSB had a highly significant (P[0.01) association with LWB, LW3 and LWW.

Least squares means for the effect of breed, TN and LSB on the BW, LWB, LW3, LWW and PWM are presented in Table 2.

Table 2 Least squares means for the effect of breed, teat number and litter size at birth on the adult body weight, litter weights at birth, three weeks and four weeks and pre-weaning mortality in broiler rabbits

Classes	n	Adult body weight		Litter weight at birth		Litter weight at three weeks		Litter weight at four weeks		Preweaning mortality	
		MSS	SE	MSS	SE	MSS	SE	MSS	SE	MSS	SE
Breed		(P=0.3787)^{NS}		(P=0.7056)^{NS}		(P=0.6936)^{NS}		(P=0.2600)^{NS}		(P=0.2306)^{NS}	
New Zealand White	27	2.9257	+0.1007	0.2477	+ 0.0113	0.9060	± 0.1263	1.4241	± 0.1897	23.5379	± 9.1304
Grey giant	26	3.0606	±0.0868	0.2513	±0.0097	0.7980	± 0.1088	1.1355	±0.1635	38.6070	±7.8701
Soviet Chinchilla	28	3.0289	±0.0840	0.2568	±0.0094	0.8507	+0.1053	1.1760	± 0.1582	35.0157	±7.6130
Teat number		(P=0.4411)^{NS}		(P=0.6963)^{NS}		(P=0.5703)^{NS}		(P=0.5054)^{NS}		(P=0.9525)^{NS}	
8	49	3.0726	±0.0706	0.2514	± 0.0079	0.8545	±0.0885	1.2549	± 0.1330	33.6280	±6.4012
9	19	2.9482	±0.0961	0.2463	± 0.0108	0.9316	± 0.1204	1.3758	+0.1809	33.0687	±8.7082
10	13	2.9937	± 0.1156	0.2581	± 0.0130	0.7686	±0.1450	1.1049	+ 0.2178	30.4639	±10.4809
Litter size at birth		(P=0.7967)^{NS}		(P=0.0000)**		(P=0.0092)**		(P=0.0167)**		(P=0.3164)^{NS}	
1	4	3.0916	± 0.1719	0.0726	± 0.0193	0.2151	± 0.2155	0.3097	±0.3237	24.5921	±15.5801
2	7	2.8786	± 0.1447	0.1131	± 0.0162	0.5012	± 0.1813	0.8333	±0.2724	22.3662	+13.1115
3	16	2.9787	±0.0904	0.1813	± 0.0101	0.6247	± 0.1134	0.9371	± 0.1703	24.7092	± 8.1967
4	5	3.0079	± 0.1635	0.2228	± 0.0183	0.5005	±0.2049	0.7342	+ 0.3078	50.8716	± 14.8161
5	25	3.0054	±0.0689	0.2731	±0.0077	0.7914	±0.0864	1.1809	+ 0.1298	40.1923	±6.2488
6	12	2.8612	±0.0984	0.2937	± 0.0110	0.7546	+0.1233	1.0889	± 0.1853	45.2489	± 8.9169
7	10	3.1053	± 0.1086	0.3340	± 0.0122	0.9001	± 0.1362	1.3092	±0.2046	46.3836	±9.8459
8	1	3.2389	±0.3447	0.4007	+ 0.0387	1.4079	±0.4321	1.8045	±0.6492	41.1530	±31.2441
9	1	2.8758	±0.3446	0.3762	±0.0387	1.9685	+ 0.4320	3.0091	±0.6489	4.0349	+31.2338

** Significant at 1 % level NS - Non significant

BW of different broiler rabbit breeds averaged 3.011 kg. The average BW of NW, GG and SS does were 2.93+1.00, 3.06±0.09 and 3.03±0.08 kg respectively. The mean PW.M among different broiler rabbit breeds was 37.01 per cent and it averaged 23.55+9.13, 38.61±7.87 and 35.02+7.61 per cent among NN, GG and SS breeds respectively. As expected the lowest LWB was for LSB of one which increased continuously reaching the highest LWB of 0.401+0.039 kg for the LSB of eight. LW3 was also the lowest for the LSB of one showing an increased trend reaching the highest LW3 of 1.968±0.432 kg for the LSB of nine. Viroji Rao *et al.* (1994) could find no significant effect of the breed type of the litter weight traits. Grobner *et al.* (1995) and Vicente and Garcia Zimenez (1992) reported significant effect of breed on litter traits under temperate climate.

Nonsignificant breed effect on BW and litter weight traits necessitate further studies to confirm the association between breed, BW and litter weight traits. The humid tropical stresses might have a general depressant effect on the growth, among temperate breeds, which might influence the association between breed, BW and litter weight traits.

The nonsignificant association between breed and PWM in this study is supported by the findings of Farghaly (1996) who could find no significant influence of breed on the PWM among broiler rabbits from Egyptian tropics. The results of both these studies point out to the adverse effect of tropical stresses leading to heavy PWM in rabbit bunnies.

BW, LWB, LW3 and LWW had no specific association with the TN of the doe. Similarly, PWM of kits were also found to be associated with TN classes. TN among rabbits has been reported to be correlated significantly with litter traits (Lukefahr *et al.*, 1984). Feischhauer *et al.* (1985) attributed the increase in TN to superior litter performance. The non-significant association obtained in the present study might be due to the small LSB ranging from 1-7 in more than 97 per cent of the does studied. This small LSB of less than eight teats in the doe had insignificant advantage on the growth traits and PWM.

The association between BW, PWM, LSB were not significant. Bironi *et al.* (1989) reported that a higher BW of the doe with increased LSB. Nemeth *et al.* (1989) attributed a higher BW of the doe with lowered PWM. The results of this study would probably be a result of the detrimental effect of humid tropical stress on the BW of the broiler rabbits reducing its variability.

The highly significant effect ($P \leq 0.01$) of LSB on the LWB, LW3 and LWW obtained in this study is in agreement with the earlier studies (Khalil *et al.*, 1987; El-Sheikh and El-Bayoni, 1994) pointing to the feasibility of selection for increased LSB as an important economic trait in rabbit.

Table 3 Phenotypic correlation between adult body weight, litter weights at birth, three weeks and four weeks and pre-weaning mortality in broiler rabbits

	Adult body weight	Litter weight at birth	Litter weight at three weeks	Litter weight at four weeks	Preweaning mortality
Adult body weight	1.0000	0.1036^{NS}	-0.0451^{NS}	0.0001^{NS}	-0.0127^{NS}
Litter weight at birth		1.0000	0.3821**	0.4827**	-0.5181**
Litter weight at three weeks			1.0000	0.8830**	-0.7769**
Litter weight at four weeks				1.0000	-0.8388**
Preweaning mortality					1.0000

**Significant at 1% level NS Non significant

Table 3 details the phenotypic correlation between BW, LWB, LW3, LWW and PWM among broiler rabbits.

LWB had a highly significant ($P \leq 0.01$) correlation with LW3 and LWW. LW3 was also having a highly significant ($P \leq 0.01$) correlation of 0.883 with LWW. Earlier Khalil *et al.* (1986, 1987) reported a highly significant phenotypic correlation among different litter weight traits. PWM had a highly significant ($P \leq 0.01$) negative correlationof (-) 0.518, (-) 0.777 and (-) 0.839 with LWB, LW3 and LWW respectively. Similar results were obtained by Farghaly (1996) and Krogmeier and Dzapo (1991). The higher litter weights at different stages might be indicative of a better health status of the bunnies contributing reducing PWM.

Summary

First kindling performance of 81 purebred rabbits aged 6-12 months and belonging to three broiler breeds namely New Zealand White (NW), Grey Giant (GG) and Soviet Chinchilla (SS) were studied at the humid tropics of Kerala. The effect of breed, adult body weight (BW), and teat number (TN) of the doe and litter size at birth (LSB) on the litter weight at birth (LWB). litter weight at three weeks (LW3), litter weight at weaning (LWW) and preweaning mortality (PWM) were analysed. Phenotypic correlation between litter traits, BW and PWM were estimated. Breed and TN had no significant effect on BW, LWB, LW3, LWW and PWM. LSB had a highly significant ($P \leq 0.01$) influence on the LWB, LW3 and LWW. Phenotypic correlation among LWB, LW3 and LWW were highly significant ($P \leq 0.01$). LWB, LW3 and LWW had highly significant ($P \leq 0.01$) correlation of (-) 0.518, (-) 0.777 and (-) 0.839 respectively with PWM.

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