CROSSBREEDING EFFECTS FOR POST-WEANING GROWTH, RECTAL AND EAR TEMPERATURES AND RESPIRATION RATES IN CROSSING SAUDI GABALI WITH SPANISH V-LINE RABBITS

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INTRODUCTION

To date, publications concerning crossbreeding of Gabali rabbits with standard breeds (e.g. Spanish V-line) in Saudi Arabia are not available. V-line has proved to be advantageous to standard California and New Zealand White for daily gain in Egypt. Gabali rabbits raised under the Saudi desert conditions are characterized by a large litter size of 8 - 10 young and heavy body weight of 3.2 - 3.8 kg. The objective of the present paper was to estimate direct (G^I) and maternal (G^M) additive effects, direct (H^I) and maternal (H^M) heterosis and direct recombination effects (R^I) for body weights, rectal and ear temperatures and respiration rates in a crossbreeding project involving Saudi Gabali and V-line rabbits.

MATERIAL AND METHODS

Breeding plan and data collected. Rabbits used in this study represent one desert Saudi breed (Gabali, G) and one exotic breed (Spanish V-line, V). Eighty pedigreed does and sixteen bucks of the V-line rabbits were imported from Valencia University, Spain in September 2000. The breeding plan permitted the simultaneous production of V, G, ½G½V, ½V½G, ¼V¾G and ¾V¼G rabbits in two generations. Rabbits were raised in semi-closed rabbitry (25-32 ^oC). Within the two generations, a total number of 3188 weaned rabbits fathered by 40 sires and mothered by 223 dams were obtained. Live body weights were recorded at 6 weeks (W6), 8 weeks (W8), 10 weeks (W10) and 12 weeks (W12). Physiological reactions to climatic stress such as rectal temperatures at 6 (RT6) and 12 (RT12) weeks of age, ear temperatures at 6 (ET6) and 12 (ET12) weeks, and respiration rates at 6 (RR6) and 12 (RR12) weeks were also recorded. Rectal and ear temperatures (^oC) were measured by digital thermometer (Thermoscan), while respiration rates (breath/min) were recorded using stopwatch.

Models of analysis. Variances (co) used as starting values in the analyses of multi-trait animal model were calculated by SAS program (SAS, 1996). The multi-traits animal model (Boldman *et al.*, 1995) was used for analysing body weights (set 1), rectal and ear temperatures (set 2) and respiration rates (set 3). The MME in multi-trait animal model were too large and therefore we analysed each set of data separately. The model used was :

$$\boldsymbol{y = Xb + Z_a u_a + Z_C u_C + e}$$

Where **y** = vector of observed trait of animals, **b** = vector of fixed effects (represented as genetic group, generation, year-season of birth, parity, sex, litter size at birth), $\mathbf{u_a}$ = vector of random effect of the animal, $\mathbf{u_C}$ = vector of random effect of the common litter, **X**, $\mathbf{Z_a}$ and $\mathbf{Z_C}$ are the incidence matrices relating records to fixed effects, the additive genetic effects of the rabbit and common litter effect, respectively, and **e** = vector of random residual effects. The Dickerson's genetic model (Dickerson, 1992) was used to derive some sets of linear contrasts. The genetic components for data of the two generations were : $\mathbf{G^I}$ = individual (direct) additive effect of the rabbit (progeny) ; $\mathbf{G^M}$ = maternal additive effect of the dam of rabbit ; $\mathbf{H^I}$ = individual (direct) heterosis in the crossbred rabbit ; $\mathbf{H^M}$ = maternal heterosis in the crossbred dam ; $\mathbf{R^I}$ = direct recombination effect in the individual rabbit. Coefficients for the expected contribution of genetic effects in G or V and their crosses were computed according to Dickerson (1992).

RESULTS AND DISCUSSION

Genetic-group means and comparisons. Least square means for different traits in purebreds and crossbreds are given in table 1. For most cases, the V x V matings resulted in heavier body weights compared to the G x G matings. On the other hand, physiological parameters of rectal and ear temperatures and respiration rates were similar in both strains of the study. No significant differences were observed between the six genetic groups regarding rectal and ear temperatures and respiration rates (table 1). Ear temperatures were 38.2, 38.3, 38.3, 38.4, 38.2 and 38.2 ^oC for the genetic groups of VxV, GxG, GxV, VxG, ¾G¼V and ¾V¼G, respectively. Rectal temperatures in different genetic groups were nearly similar and being 36.7, 36.6, 36.7, 36.7, 36.6 and 36.4 ^oC for the same respective groups. The respiration rates in VxV, GxG, GxV, VxG, ¾G¼V and ¾V¼G were also nearly similar and being 126.4, 125.9, 125.9, 125.5, 128.1 and 124.6 breath/min., respectively (table 1).

Table 1. Purebred and crossbred means (± SE) for different traits

Trait	V-line (V)	Gabali (G)	½V½G	½G½V	¾G¼V	¾V¼G
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
	N= 739	N= 665	N= 746	N= 671	N= 154	N= 213
Body weight (g) :						
W6	1286±16a	1129±15bc	1155±16b	1129±16d	1181±35bc	1155±22cd
W8	1738±19a	1511±19c	1575±19b	1564±19c	1604±45bc	1568±27c
W10	1955±22a	1858±21b	1938±21a	1949±22ab	2033±53a	1942±30b
W12	2404±24a	2213±22c	2348±23ab	2339±24bc	2389±59ab	2332±34c
Rectal and ear temperatures (^oC) :						
RT6	37.0±.30a	36.7±.31a	36.8±.31a	36.6±.31a	36.2±.78a	36.2±.44a
RT12	36.5±.07b	36.6±.07b	36.6±.07b	36.7±.07b	37.0±.19a	36.7±.11b
ET6	38.3±.04a	38.4±.04a	38.4±.04a	38.3±.04a	38.4±.11a	38.3±.06a
ET12	38.2±.04a	38.3±.04a	38.3±.04a	38.3±.04a	38.0±.11a	38.1±.06a
Respiration rate (breath/min) :						
RR6	128.1±.9ab	127.4±1.0ab	126.2±1.0b	126.4±1.0b	129.9±2.5a	125.8±1.4a
RR12	124.8±1.1a	124.4±1.1a	124.9±1.1a	125.4±1.1a	126.3±2.8a	123.5±1.6a

Means with the same superscript in each row are not significantly different (P<0.05).

Direct (G^I) and maternal (G^M) additive effect. All estimates of G^I (i.e. G^I_V-G^I_G) and G^M for physiological parameters were very low for rectal and ear temperatures and respiration rates (table 2). Estimates of G^I and G^M were of some importance at early stages of growth. Most estimates for body weights were moderate and significant and in favor of V-line rabbits (table 2). V-line was originated from New Zealand White and this reflected the desirable maternal additive effect in this line compared to G rabbits. Such differences in G^I for body weights between the two breeds lead to state that V-line rabbits could be used as a buck-breed in crossbreeding programmes in Saudi Arabia. Khalil *et al.* (1995) and Khalil and Afifi (2000) in Egypt reported that estimates of G^M for post-weaning growth were significant. In crossing of Californian or New Zealand White with Gabali rabbits in Egypt, Ali (1998) and Abdel-Aziz (1998) concluded that G^M for body weights and daily gains after weaning were significantly in favor of Californian or New Zealand White.

Direct recombination effect (R^I). Estimates of R^I for most traits were not significant (table 3).

Table 2. Estimates of direct (G^I) and maternal (G^M) additive effects for different traits

Trait	Direct additive		Maternal additive	
	Units ±SE	G^I %^{a}	Units ±SE	G^M %^{a}
Body weight (g) :				
W6	175.2±4.5	14.6***	135.6±4.94	11.8***
W8	260.6±5.31	16.3***	189.6±5.77	12.2***
W10	139.6±5.76	7.2**	14.0±6.18	0.7NS
W12	217.0±6.21	9.2**	105.4±6.59	4.6*
Rectal and ear temperatures (°C) :				
RT6	0.26±0.05	0.7^{NS}	0.44±0.04	1.2^{NS}
RT12	0.079±0.012	0.2^{NS}	-0.17±0.01	-0.5^{NS}
ET6	-0.12±0.01	-0.3^{NS}	-0.11±0.01	-0.3^{NS}
ET12	0.11±0.01	0.3^{NS}	-0.05±0.01	-0.1^{NS}
Respiration rate (breath/min) :				
RR6	1.25±0.17	1.0^{NS}	1.13±0.15	0.9^{NS}
RR12	0.56±0.18	0.4^{NS}	-1.35±0.15	-1.1^{NS}

^{a}**G^I %**= [G^I in units / (average of V + V-sired crosses)]x100 ; **G^M %**= [G^M in units / (average of **G** + **G**-dammed crosses)]x100 ; NS= Non-significant ; *= P<0.05 ; **= P<0.01 ; ***= P<0.001.

CONCLUSION

Insignificant differences recorded between the six genetic groups for physiological parameters that V-line rabbits and their crosses could produce and reproduce efficiently under hot climatic conditions. Since reproductive efficiency of V-line rabbits was higher than that of G breed for body weights of the present study (P < 0.01 or P < 0.001), therefore, it may be effective to use V-line rabbits as a breed of dam in any crossbreeding stratification system in hot climatic regions.

Table 3. Estimates of direct (H^I) and maternal (H^M) heterosis (calculated in actual units and percentages) and direct recombination loss (R^I) for different traits

Trait	Direct heterosis		Maternal heterosis		Recombination loss
	Units ±SE	%	Units ±SE	%	Units±SE
Body weight (g) :					
W6	105.6±9.64	9.5***	112.9±8.42	10.2***	28.2±2.1^{NS}
W8	36.3±6.02	2.4^{NS}	7.6±7.68	0.5^{NS}	-1.9±1.9^{NS}
W10	68.0±6.54	3.6*	23.4±8.50	1.2^{NS}	5.8±2.1^{NS}
W12	66.2±6.95	2.9*	12.9±9.17	0.6^{NS}	-3.2±2.2^{NS}
Rectal and ear temperatures (°C) :					
RT6	1.71±0.11	4.6^{NS}	1.83±0.12	5.0^{NS}	-0.45±0.03 ^{NS}
RT12	0.59±0.04	1.6^{NS}	0.71±0.03	1.9^{NS}	0.18±0.01 ^{NS}
ET6	0.18±0.02	0.5^{NS}	0.13±0.02	0.3^{NS}	0.03±0.01 ^{NS}
ET12	0.04±0.02	0.1^{NS}	0.25±0.02	0.7^{NS}	-0.06±0.01 ^{NS}
Respiration rate (breath/min) :					
RR6	2.19±0.05	1.7^{NS}	3.55±0.44	2.8^{NS}	0.89±0.11 ^{NS}
RR12	1.53±0.56	1.2^{NS}	0.31±0.48	0.2^{NS}	0.08±0.12 ^{NS}

NS= Non-significant ; *= P<0.05 ; **= P<0.01 ; ***= P<0.001.

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