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BREED GENETIC COMPONENTS OF SOME LAMB GROWTH TRAITS OF EGYPTIAN RAHMANI AND OSSIMI BREEDS, AND THEIR CROSSES WITH FINNSHEEP

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SUMMARY

A total of 7245 lamb records of Rahmani (R) and Ossimi (O) Egyptian sheep breeds and their crosses with Finnsheep (Finnish Landrace; F) over 16 years were used in this investigation. Thirteen mating types were represented in this study: R and its crosses; F.R, FR.R and R.FR as well as its first, second and third *inter se* mating: $(R.FR)^1$, $(R.FR)^2$ and $(R.FR)^3$, respectively, and O and its crosses; F.O, FO.O, O.FO, $(O.FO)^1$ and $(O.FO)^2$.

Data on body weights at birth (BW), weaning (WW; 60 days of age), 4 (W4), 6 (W6), 12 (W12) and 18 (W18) months of age were analyzed to study the effects of breed group, sex of lamb, season of birth, type of birth and age of ewe at lambing. The individual heterosis, maternal heterosis and individual recombination losses, were also estimated for R and O crosses.

Breed group had an effect ($P<0.01$) on body weight at all ages. Single lambs were significantly heavier than twin lambs at all ages, while twin lambs were heavier than triplet lambs at birth and weaning. Season of birth had a significant effect on BW, WW, W4 and W6. Spring born (February) lambs were heavier at BW, WW, W4, W6 and W18. Age of dam had an effect ($P<0.01$) on BW, WW, W4, W6 and W12.

For Rahmani and its crosses, the effect of individual heterosis was significantly positive on W6. Maternal heterosis was significantly positive on BW. Individual recombination was significantly positive on WW, W6 and W12.

In Ossimi and its crosses, the effect of individual heterosis was significantly negative on WW. Maternal heterosis was significantly positive on WW and W6 and individual recombination was significantly positive on all studied traits.

In conclusion, estimates of heterotic components for body weights were generally non significant and did not show a clear trend.

Keywords: Rahmani, Ossimi, Finnsheep, crossbreeding, growth, weight, lamb, heterosis, recombination

INTRODUCTION

Variation among breeds of sheep offers the chance to increase production efficiency in commercial sheep flocks through crossbreeding. Egyptian sheep breeds are characterized by low prolificacy which limits the annual lamb offtake. Finnsheep sheep have been extensively utilized for corssbreeding with a wide range of sheep breeds in many countries to enhance lambing rate. In 1974, the Egyptian Ministry of Agriculture started a crossbreeding program with Finnsheep to improve prolificacy of two local breeds R and O and to constitute synthetic breeds of higher fecundity suitable for the prevailing subtropical conditions. This study was carried out to evaluate the genetic and non-genetic factors affecting the growth of the crossbred lambs and to estimate the individual heterosis, maternal heterosis and the individual recombination loss for body weight at various ages.

MATERIALS AND METHODS

Data and management. Data used in this study were collected from sheep flocks raised in two experimental farms belonging to the Egyptian Ministry of Agriculture during the years from 1974 to1989. A total of 7245 records of R, O and different crosses were used in the study.

An accelerated lambing system of three matings per two years was practiced. The mating seasons were; May, January and September. Lambs were weaned at about two months of age.

The flocks were allowed to graze on Egyptian Clover (berseem) *Trifolium alexandrinum* in the period from December to May, and on crop stubble (wheat and vegetables) and on green fodder (Sorghum) if available. In addition a concentrate mixture (24% corn, 38% cottonseed meal, 37% wheat barn and 1% salt), berseem hay and rice straw were offered in summer and autumn. Supplementary concentrate feeding of about ¼ kg/head was offered to the ewes two weeks prior to the onset of the mating season for flushing and also during the last two to four weeks of pregnancy through the first week of lactation. Animals were allowed to drink twice or thrice a day. Animals were sheared twice a year, in March and September. Ewes and rams were first mated at about 18 months of age. New born lambs were identified and their weight, type of birth, sex and pedigree were recorded.

Estimation of genetic components. The theory of estimating genetic components from crossbreeding data was proposed by Dickerson (1969, 1973). The estimated genetic components in this study were: the average direct effects of the individual breed; g^I, the maternal genetic effect of the breed; g^M, the individual heterosis in the crossbred progeny; h^I, the heterosis in the crossbred dam; h^M and the recombination losses in the individual; r^I.

The coefficients for the expected contribution of genetic effects in the purebreds (Rahmani and Ossimi) and their crosses according to Dickerson (1969) are presented in Table 1.

Table 1. Coefficients of expected contribution for genetic effects in the purebreds Rahmani (R) and Ossimi (O) and their crossbreds with Finnsheep (F)

Mating type [a]	g^I_L	g^I_F	g^M_L	g^M_F	h^I_{LF}	h^M_{LF}	r^I_{LF}
L.L	1	0	1	0	0	0	0
F.L	1/2	1/2	1	0	1	0	0
L.FL	3/4	1/4	1/2	1/2	1/2	1	1/4
FL.L	3/4	1/4	1	0	1/2	0	1/4
(L.FL)[1]	3/4	1/4	3/4	1/4	3/8	1/2	1/4
(L.FL)[2]	3/4	1/4	3/4	1/4	3/8	3/8	1/4
(L.FL)[3]	3/4	1/4	3/4	1/4	3/8	3/8	1/4

[a] The first letter(s) before the dot represents breed of sire, and the second letter(s) after the dot presents breed of dam. L= Local breeds (Rahmani or Ossimi), except for (L.FL)3, where L means Rahmani only, and F= Finnsheep

Statistical analysis. Data were analyzed by fitting a least squares fixed model, Harvey's Mixed Model (1990), to estimate least squares means for the breed group effect for BW, WW, W4, W6, W12 and W18. The fixed effects considered in the model were: breed group (BR), flock (L), sex (S), age of dam at lambing (AG), type of birth (T), season of birth (SN), year (block of years) of birth (BLK) and the interactions between: BR and SN, S and T, S and BLK, AG and SN, T and SN and SN and BLK.

Years were divided into eight blocks. Each block is a period of 2 years (three lambing seasons). Age of dam was classified into five age classes (17-26, 27-43, 44-71, 72-98 and >98 months). Age of lamb in days at WW, W4, W6,W12 and W18 were used as a covariate. Due to missing subclasses, the breed-season and season-block of years interactions were omitted when analyzing W18.

The breed group effect was replaced in another fixed model to estimate the partial regressions associated with five covariate terms reflecting five estimable breed genetic components following the techniques developed by Dickerson (1969) as shown in Table 2 (Mansour and Aboul-Naga, 1988). These covariate terms were: The deviation of the additive effect of the individual genes of L from F (g^I_{L-F}), The deviation of the additive effect of the maternal individual genes of L from F (g^M_{L-F}), The effect of the individual heterosis for L and F (h^I_{LF}), The effect of the maternal heterosis for L and F (h^M_{LF}) and The effect of the individual recombination for L and F (r^I_{LF}).

Table 2. Covariate terms for estimating breed genetic components under different mating types

Mating type [a]	$g^{I}_{L\text{-}F}$	$g^{M}_{L\text{-}F}$	h^{I}_{LF}	h^{M}_{LF}	r^{I}_{LF}
L.L	1	1	0	0	0
F.L	0	1	1	0	0
L.FL	1/2	0	1/2	1	1/4
FL.L	1/2	1	1/2	0	1/4
(L.FL)[1]	1/2	1/2	3/8	1/2	1/4
(L.FL)[2]	1/2	1/2	3/8	3/8	1/4
(L.FL)[3]	1/2	1/2	3/8	3/8	1/4

[a] See footnote below Table 1.

RESULTS AND DISCUSSION

The results of the analysis of variance showed in general highly significant effect for all main effects on all studietraits ($P<.01$) except for the effect of season of birth on W12 and W18 and the effect of age of dam on W18 where the did not have any significant effect. Some interactions showed significant effect on some of the studied traits.

Least squares means for lamb body weights at different ages (Tables 3 and 4), indicate that, among the Rahmani groups Rahmani lambs were the heaviest at BW, W6 and W18, while F.R lambs were the heaviest at WW and W4, but $(R.FR)^3$ lambs showed the heaviest weight at W12. Among the Ossimi groups, FO.O lambs were the heaviest at all ages except at birth, where the Ossimi lambs were the heaviest.

Estimates of $g^{I}_{R\text{-}F}$ (Table 5) showed that F lambs were superior to R lambs for BW and W18, but R lambs were superior to F lambs for WW, W4, W6 and W12. Average direct effect of the individual were significant ($P<.01$) for W18. While F lambs were superior to O lambs for WW, W12 and W18, but O lambs were superior to F lambs for BW, W4 and W6. Average direct effect of the individual were significant ($P<.05$) for WW.

The estimates of $g^{M}_{R\text{-}F}$ were significant ($P<.01$) for BW and ($P<.05$) for W4, while the same estimates for O and F breeds were significant ($P<.01$) for WW and W6 and ($P<.05$) for BW. Table (5) showed that R ewes were superior to F ewes for BW, WW, W4, W6 and W18, but F ewes were superior to R ewes for W12. While O ewes were superior to F ewes for body weight at different ages.

Individual heterosis h^{I}_{RF} was significant for W6 ($P<.01$), indicating that crossbred lambs had higher body weight 6 months than those of purebred lambs. While h^{I}_{OF} for WW ($P<.05$) was significant indicating that purebred lambs had higher body weight at weaning than those purebred lambs. The estimates for BW were -0.12 and -0.13 kg for h^{I}_{RF} and h^{I}_{OF}, respectively. Those estimates for BW are in close agreement with the findings of Manjeli (1983), who worked on Finnish Landrace, Suffolk, Targhee and Minnesota

100, F1, F2 and backcross sheep. He observed negative heterosis for BW. Konstantinov *et al.*, (1988) reported negative estimate for the individual heterosis for W18.

Table 3. Least squares means (LSM), standard errors (SE) and probability of type I error (P) for birth (BW), weaning (WW) and 4 months (W4) weights, kg

Factor	BW			WW			W4		
	No.	LSM	SE	No.	LSM	SE	No.	LSM	SE
μ	7245	3.00	.03	6123	12.82	.14	6135	17.7	.17
Breed group :		P<.00			P<.00			P<.00	
R	458	3.16	.05	209	12.94	.29	426	17.9	.29
F.R	1069	3.15	.03	926	13.22	.17	870	18.1	.21
R.FR	1397	2.82	.03	1273	12.50	.16	1164	17.5	.20
FR.R	200	3.09	.08	193	12.98	.37	179	17.6	.45
$(R.FR)^1$	857	3.00	.04	715	12.83	.19	717	17.4	.22
$(R.FR)^2$	797	2.90	.04	691	12.69	.20	673	17.1	.25
$(R.FR)^3$	83	2.87	.09	77	12.70	.41	68	16.9	.55
O	287	3.20	.06	143	12.72	.32	267	18.1	.32
F.O	697	2.92	.04	619	12.62	.19	580	17.5	.23
O.FO	585	2.85	.04	530	12.49	.20	484	17.4	.25
FO.O	213	3.01	.06	190	13.07	.30	177	18.7	.37
$(O.FO)^1$	464	3.00	.05	434	13.02	.24	406	17.7	.30
$(O.FO)^2$	138	2.97	.07	123	12.93	.34	124	17.9	.42
Sex :		P<.00			P<.00			P<.00	
Male	3554	3.10	.03	3006	13.31	.16	2995	18.7	.20
Female	3691	2.90	.03	3117	12.33	.16	3140	16.6	.19
Age of dam:		P<.00			P<.00			P<.00	
17-26 mo	1254	2.71	.03	1076	12.14	.17	1043	16.9	.21
27-43 mo	2040	2.95	.03	1711	13.04	.16	1729	17.9	.19
44-71 mo	2292	3.12	.03	1971	13.26	.15	1981	18.4	.18
72-98 mo	1221	3.14	.03	1001	13.14	.17	1029	18.0	.20
>98	438	3.06	.04	364	12.53	.22	353	17.2	.27
Type of birth :		P<.00			P<.00			P<.00	
Single	3753	3.66	.02	3126	14.86	.11	3197	19.6	.12
Twin	3180	2.93	.02	2728	12.12	.11	2694	16.7	.12
Triplet	312	2.40	.06	269	11.49	.33	244	16.8	.42
Season of birth:		P<.00			P<.00			P<.00	
February	2885	3.13	.03	2634	14.62	.21	2533	19.8	.20
May	2020	2.94	.05	1678	11.66	.29	1649	17.0	.37
October	2340	2.93	.04	1811	12.19	.23	1953	16.2	.27
Residual mean square:									
		0.47			9.53			13.84	

Table 4. Least squares means (LSM) and standard errors (SE), kg, for body weight at 6 (W6), 12 (W12) and 18 month of age, kg

Factor	W6			W12			W18		
	No.	LSM	SE	No.	LSM	SE	No.	LSM	SE
μ	5606	23.3	.22	4375	35.3	0.32	2228	42.2	.48
Breed group :		P<.00			P<.00			P<.00	
R	404	23.8	.36	322	32.9	0.49	196	44.1	.66
F.R	788	23.3	.27	690	35.2	0.35	277	42.1	.59
R.FR	1071	23.1	.25	793	35.8	0.34	420	42.2	.54
FR.R	159	23.3	.54	129	35.3	0.71	28	40.8	1.21
$(R.FR)^1$	647	22.4	.28	452	34.9	0.40	226	42.2	.61
$(R.FR)^2$	596	22.7	.32	449	35.7	0.44	252	42.2	.63
$(R.FR)^3$	55	23.1	.73	32	38.4	1.96	26	41.7	1.27
O	250	24.0	.40	188	32.0	0.57	118	40.9	.75
F.O	524	22.7	.29	445	34.2	0.39	256	40.9	.59
O.FO	449	22.8	.31	365	35.0	0.43	204	41.4	.61
FO.O	172	24.1	.46	133	36.9	0.63	40	43.8	1.04
$(O.FO)^1$	379	24.0	.38	287	35.9	.53	144	43.2	.70
$(O.FO)^2$	112	23.2	.53	90	36.6	.74	41	42.9	1.09
Sex :		P<.00			P<.00			P<.00	
Male	2638	25.0	.25	1764	38.6	.37	624	47.4	.60
Female	2968	21.6	.24	2611	32.0	.35	1604	37.0	.51
Age of dam:		P<.00			P<.00			P<.08	
17-26 mo	935	22.3	.26	721	34.5	.31	403	41.5	.55
27-43 mo	1590	23.4	.24	1244	35.5	.28	612	42.0	.52
44-71 mo	1835	23.8	.23	1422	35.9	.27	732	42.6	.50
72-98 mo	934	23.5	.26	738	35.7	.30	358	42.3	.55
>98 mo	312	23.2	.34	250	34.9	.40	123	42.6	.77
Type of birth :		P<.00			P<.00			P<.00	
Single	2910	25.0	.15	2321	36.5	.24	1132	43.0	.32
Twin	2458	22.2	.16	1877	34.4	.25	989	41.1	.34
Triplet	238	22.7	.54	177	35.0	.73	107	42.5	1.22
Season of birth:		P<.00			P<.07			P<.06	
February	2328	24.8	.24	1819	34.7	.34	1135	43.2	.41
May	1538	21.8	.49	1279	35.0	.64	515	40.8	1.02
October	1740	23.2	.33	1277	36.2	.60	578	42.6	.70
Residual mean square:									
		19.52			28.58			31.78	

Table 5. Estimates of genetic components for birth (BW), weaning (WW), 4 (W4), 6 (W6), 12 (W12) and 18 (W18) month weights, kg

Component [a]	BW	WW	W4	W6	W12	W18
Finn Rahmani:						
g^{I}_{R-F}	-0.16	2.26	3.26	9.77**	3.18	-0.38
g^{M}_{R-F}	1.17**	0.87	3.48*	0.65	-2.71	0.23
h^{I}_{RF}	-0.12	2.56	3.24	9.57**	5.21	-4.30
h^{M}_{RF}	0.80**	-0.39	2.77	-0.44	-2.62	1.25
r^{I}_{RF}	0.13	3.87**	0.44	3.05*	5.61**	-7.52
Finn-Ossimi :						
g^{I}_{O-F}	0.11	-4.24*	3.32	2.10	-2.34	-6.07
g^{M}_{O-F}	0.92*	6.45**	2.99	8.00**	1.19	0.77
h^{I}_{OF}	-0.13	-3.63*	3.14	1.55	0.16	-6.08
h^{M}_{OF}	0.65	5.88**	1.33	5.96*	-0.47	-1.30
r^{I}_{OF}	0.42*	4.47**	6.34**	7.74**	14.72**	10.53**

[a] g^{I} = Average direct effects of the individual, g^{M} = Average direct maternal genetic effect, h^{I} = Individual heterosis, h^{M} = maternal heterosis, and r^{I} = recombination loss in the individual, R = Rahmani, O = Ossimi, F = Finnsheep,

* Significant effect at (P<.05) and ** Significant effect at (P<.01).

Positive maternal heterosis might indicate that crossbred ewes provide better maternal conditions to their progeny than these of the purebred. Brijendra-Singh *et al.* (1986) reported that estimates of maternal heterosis in Rambouillet-Malpura and Rambouillet-Chokla lambs were low and mostly negative for body weight. Maternal heterosis h^{M}_{RF} was significant for BW (P<.01) indicating the superiority of crossbred ewes to purebred ewes in this trait.

Maternal heterosis h^{M}_{OF} was significant for WW (P<.01) and W6 (P<.05) indicating the superiority of crossbred dams to purebred ewes in these traits. Such finding related to h^{M}_{OF} for WW was in agreement with the finding of Gunawan *et al.* (1985).

The etimates of r^{I}_{RF} were significant (P<.01) and positive for WW and W12 and (P<.05) for W6 (Table 5). While for riOF were significant (P<.01) and positive for WW, W4 W6 W12 and W18 and (P<.05) for BW (Table 5). A significant individual recombination loss for these traits indicates that crossbred rams produce heavier lambs than did purebred rams when both groups were mated to the same crossbred ewes.

CONCLUSIONS

Estimates of heterotic components for body weights were generally non significant and did not show a clear trend. However, theseestimates could be of help for predicting the performance of other genotypes. Moreover, these results indicate that, in case of using crossbreeds with F to improve fecundity mainly does not work against the growth performance of the new genotypes.

REFERENCES

Baas, T.J., L.L. Christian and M.F. Rothschild, 1992. Heterosis and recombination effects in Hampshire and Landrace swine: I. Maternal traits. J. Anim. Sci.. 70: 89-98.

Brijendra-Singh, P.N. Bhat and M. Mohan, 1986. Heterosis in body weights, fleece characteristics, reproduction and survival traits in sheep. Wool and Woollens of India. 23:33.

Dickerson, G. E., 1969. Experimental approaches in utilizing breed resources. Anim. Breed. Abstr. 37:191.

Dickerson, G.E., 1973. Inbreeding and heterosis in animals. In:Proc. Animal Breeding and Genetics Symp. in Honor of J.L. Lush. pp 54-77. ADSA and ASAS, Champaign, IL.

Gunawan, B., J.W. James and B.J. McGuirk, 1985. Maternal heterosis for lamb body weights in synthetic Border Leicester-Merino populations. Proceedings of the 5th Conference, Australian Association of Animal Breeding and Genetics, University of New South Wales, Sydney, New South Wales, Australia, 26-28 August, 232-233.

Harvey, W.R., 1990. User's guide for LSMLMW and MIXMDL, Least- Squares and Maximum Likelihood Computer Program. The Ohio State University, Columbus (Mimeo).

Konstantinov, K.V. and V. Tsvetanov, 1988. An evaluation of additive, maternal and general heterosis in crossbreeding. Genetica i Selektsiya. 21:82.

Manjeli, Y., 1983. Heterosis and recombination effects in sheep. Dissertation Abstr. International, B Sciences and Engineering. 43:3478.

Mansour, H. and A.M. Aboul-Naga, 1988. Prediction of the performance of synthetic sheep strains utilizing Finnsheep and native sheep breeds in Egypt. J. Agric. Sci. in Finland. 60:530.

المكونات الوراثية للسلالة لبعض صفات النمو لحملان سلالتى الرحمانى والأوسيمى المصرية وخلطانهما مع أغنام الفنلندى

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أستخدمت في هذه الدراسه السجلات المتاحه على ٧٢٤٥ من الحملان من سلالتى الرحماني (ر) الأوسيمي (و) وخلطانهما المختلفه مع سلالة أغنام الفنلندي (ف). جمعت السجلات المستخدمه من عام ١٩٧٤ الي عام ١٩٨٩ من مزرعتي محلة موسي و سخا التابعتين لوزارة الزراعه تحت نظام ثلاث ولادات كل سنتين.

سجلت أوزان الحملان عند الميلاد ثم بصوره شهريه حتى عمر ١٨ شهر.

حللت وزنات الحملان عند الميلاد ، الفطام عند عمر شهرين تقريبا، ٤، ٦، ١٢، ١٨ شهرا بإستخدام النماذج الخطيه ذات التأثيرات الثابته لدراسة تأثير المجموعه التربويه عليها و كذلك تأثير العوامل الثابته مثل المحطه، الجنس، عمر الأم، نوع الولاده، فصل السنه ، السنه و كذلك بعض التداخلات ما بين العوامل الثابته. كما تم أيضاً تقدير قوة الهجين الفردية والأمية وكذلك الإنعزالات الفرديه.

بوجه عام كان تأثير العوامل الثابته معنويا على تباينات الأوزان وكذلك أظهرت بعض التداخلات ما بين العوامل الثابته تأثيرا معنويا على الصفات المدروسه.

أوضحت نتائج وزن الجسم المقدره للرحماني و خلطانه أن الرحماني كان أثقل وزنا عند الميلاد، ٦، ١٨ شهرا ، بينما كان التركيب الوراثى (٢١١ ف.٢١١ ر) الأثقل وزنا عند الفطام، ٤ شهور، و كان التركيب الوراثى (٤١١ ف.٤١٣ ر)٣ الأثقل وزنا عند ١٢ شهر. وبالنسبه للأوسيمى و خلطانه كان الأوسيمى هو الأثقل وزنا عند الميلاد بينما كان التركيب الوراثى (٤١١ ف.٤١٣ و) أثقل وزنا عند الفطام، ٤، ٦، ١٢، ١٨ شهر.

أظهرت تقديرات المكونات الوراثيه نتيجة الخلط بين الرحمانى و الفنلندى أن قوة الهجين الفرديه كانت معنويه و موجبه لصفتي وزن الجسم عند عمر ٦ شهور . و كانت قوة الهجين الأميه معنويه وموجبه لصفتى وزن الجسم عند الميلاد بينما كانت الإنعزالات الفرديه معنويه و موجبه

لصفات وزن الجسم عند الفطام ، ٦، ١٢. بينما أظهرت تلك التقديرات نتيجة الخلط بين الأوسيمي و الفنلندى أن قوة الخليط الفرديه كانت و سالبه لصفة وزن الجسم عند الفطام. و كانت قوة الخليط الأميه معنويه و موجبه لصفتى وزن الجسم عند الفطام و٦ شهور من العمر بينما كانت الإنعزالات الفرديه معنويه و موجبه لصفات وزن الجسم عند الميلاد ، الفطام ، ٤، ٦، ١٢، ١٨ شهرا.

كما أظهرت الدراسه أن تقديرات المكونات الوراثيه لأوزان الجسم عموما غير معنويه وليس لها اتجاه واضح ، و مع ذلك فانه يمكن استخدام هذه التقديرات للتنبؤ بأداء التراكيب الوراثيه الخليطة. بالإضافه الى ذلك فان هذه النتائج توضح أنه فى حالة استخدام الخلط مع الفنلندى لزيادة انتاج الحملان فان ذلك لا يعمل فى اتجاه يؤثر على نمو هذه الحملان الخليطه.