GENETIC AND PHENOTYPIC CORRELATIONS FOR BODY WEIGHTS IN YANKASA SHEEP

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ABSTRACT

Using paternal half-sib (PHS) analysis, coefficients of genetic and phenotypic correlations between body weights of Yankasa lambs at birth, weaning (three months), six months, nine months and one year of age were estimate. The highest genetic correlation coefficient of 0.33 was obtained between birth and yearling weight. Six- month weight had very low and negative genetic correlation with yearling weight (- 0.04). Phenotypic correlation coefficients for the various body weights pairs were positive and mostly of medium magnitude (0.12 - 0.47).

Key words: Tropics, Yankasa sheep, body weights, correlation

INTRODUCTION

Genetic and phenotypic correlations are essential for predicting indirect responses to selection and for determining the optimum weighting and expected response to selection when improving more than one trait. Very few coefficients of phenotypic correlation are available for the Nigerian breeds of sheep (Buvanendran *et al.*, 1981; Taiwo *et al.*, 1982). No coefficient of genetic correlation between pre- weaning and post-weaning body weights in these breeds has been reported. This study was therefore carried out to obtain coefficients of genetic and phenotypic correlations between body weights of Yankasa lambs at five stages of growth.

MATERIALS AND METHODS

Records of birth and monthly body weights up to one year of age collected between 1981 and 1985 from an accelerated lambing scheme project at the National Animal Production Research Institute, Shika, were analysed. The history and management of the flock were as earlier reported (Osinowo, 1982)). Except for birth weight, correlation for differences in the ages of the lambs at weighing at three months, six months, nine months and one year was done by multiplying average daily liveweight gain (ADG) during the period under consideration by the average age of the lamb at each stage (Table 1). Using least squares procedures (Harvey, 1960) the data were adjusted for the effects of type of birth, sex, parity and sire-group (Hassan, 1987). Table 2 gives the least squares mean for lamb weights at the five stages of growth. With the aid or SPSS sub-program 'Anova', analysis of variance of cross products was employed to obtain components of covariance between breeding values of the growth traits. The covariance and variance components of the traits were used to estimate both the genetic and phenotypic correlations. Genetic correlation, r_G, was estimated as:

$$r_G = \sigma_{s(x)}\ \sigma_{s(y)} / [\sigma^2_{s(x)}\ \sigma^2_{s(y)}]^{1/2}$$

Standard error of this correlation was estimated according to Robertson (1959) thus:

$$S.E.(r_G) = \frac{1 - r_G^2}{\sqrt{2}} \sqrt{\frac{S.E.(h_x^2)\ S.E.(h_y^2)}{h_x^2 \cdot h_y^2}}$$

where:

$S.E.(h_x^2)$, $S.E.(h_y^2)$ = standard error of heritability of traits x and y, respectively.

(h_x^2), (h_y^2) = heritability of traits x and y, respectively.

TABLE 1. MEAN ±S. D. FOR BIRTH WEIGHT AND AGE-ADJUSTED BODY WEIGHT OF LAMBS (KG)

	Birth			3 Months			6 Months			9 Months			12 Months		
Variable	No	Mean	S.D.	No	Mean	S.D	No	Mean	S.D.	No	Mean	S.D.	No.	Mean	S.D.
Type of birth															
Single	257	2.63	0.65	216	11.67	3.17	123	16.20	3.36	110	21.00	4.27	70	24.97	5.67
Twin	100	2.20	0.51	82	8.85	2.53	44	13.01	3.16	34	18.32	3.75	22	23.01	4.15
Sex of Lamb															
Male	185	2.61	0.67	142	11.57	3.31	69	16.28	3.36	54	22.50	4.25	48	26.89	4.51
Female	172	2.40	0.59	156	10.28	3.09	98	14.71	3.61	90	19.09	3.80	44	21.90	5.10
Parity of ewe															
1	102	2.34	0.67	82	11.05	3.35	57	15.06	3.69	49	21.07	4.04	31	24.21	5.10
2	88	2.57	0.62	75	10.87	2.75	52	15.24	3.37	44	19.60	3.90	25	22.96	5.42
3	89	2.50	0.56	79	10.56	3.29	40	15.39	3.52	34	19.80	4.04	23	25.35	5.30
4	53	2.67	0.68	45	11.00	3.96	18	16.56	4.04	17	21.44	6.00	13	26.66	5.77
5	25	2.61	0.67	17	11.53	2.79									
Sire group															
1	46	2.32	0.59	38	11.35	2.75	34	14.96	3.28	25	18.30	3.00	20	18.77	4.71
2	51	2.55	0.67	49	11.07	3.37	33	13.43	3.00	30	17.67	3.29	13	26.31	3.27
3	97	2.31	0.55	85	8.39	2.50	29	15.37	3.48	32	20.78	3.79	13	28.21	3.84
4	81	2.71	0.65	63	12.63	2.72	22	16.02	4.04	20	21.99	5.21	17	25.36	5.18
5	81	2.42	0.49	70	9.36	2.56	31	11.42	2.17	31	16.24	2.24			

TABLE 2. LEAST-SQUARES MEANS (LSM) FOR LAMB WEIGHTS (KG) AT FIVE STAGES OF GROWTH

	Birth		3 Months		6 Months		9 Months		12 Months	
Overall Mean	2.47		10.23		14.12		18.66		24.05	
Variable	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM
Type of birth										
Single	237	2.74	201	11.81	94	15.72	84	19.88	46	25.44
Twin	119	2.20	104	8.65	55	12.52	44	17.34	17	22.66
Sex of lamb										
Male	184	2.56	154	10.94	58	15.59	47	20.50	36	26.71
Female	172	2.38	151	9.52	91	12.74	81	16.82	27	21.39
Parity of ewe										
1	50	2.05	41	8.29	18	12.52	12	17.99	9	22.73
2	83	2.47	76	9.68	41	13.96	36	18.33	10	24.49
3	97	2.57	89	10.81	46	14.70	40	19.06	22	24.45
4	74	2.66	59	10.83	23	14.88	22	19.14	13	24.53
5	52	2.60	40	11.53	21	14.53	18	18.77		
Sire group										
1	46	2.37	38	11.44	34	14.78	25	18.38	20	20.02
2	51	2.68	49	11.57	33	13.71	30	17.49	13	24.55
3	97	2.30	85	7.93	29	14.69	22	19.39	13	25.39
4	81	2.36	63	11.75	22	15.88	20	21.63	17	26.15
5	81	2.41	70	8.96	31	11.54	31	16.42		

Phenotypic correlation, r_p, was calculated according to Becker (1968):

$$r_p = \frac{\sigma_{w(x)}\,\sigma_{w(y)} + \sigma_{s(x)}\,\sigma_{s(y)}}{[\sigma^2_{w(x)} + \sigma^2_{s(x)}]\,[(\sigma^2_{w(y)} + \sigma^2_{s(y)}]}$$

where:

$\sigma_{w(x)\,w(y)}$ = within sire component of covariance for traits x and y.

$\sigma_{s(x)\,s(y)}$ = between sire component of covariance for traits x and y.

$\sigma^2_{w(x)}, \sigma^2_{w(y)}$ = the within sire component of variance for traits x and y, respectively.

$\sigma^2_{s(x)}, \sigma^2_{s(y)}$ = the sire component of variance for traits x and y, respectively.

RESULTS AND DISCUSSION

Genetic Correlation

Table 3 gives the estimates of genetic and phenotypic correlations obtained between all five lamb body weights. The genetic correlation coefficients were generally relatively low, ranging between -0.04 and 0.33. The coefficient of 0.01 obtained between birth weight and weaning weight was muxh lower than the average of eight estimates (0.49) reported by Ragab *et al.* (1953),MacNaughton (1956) Gjedrem (1967), Fahmy *et al.* (1969), Vesely *et al.* (1970), Thrift *et al.* (1973), and Raman *et al.* (1981), ranging from 0.24 to 1.04. It was however very close to 0.12, 0.14 and 0.13 reported by Chopra and Acharya (1971), Urala (1978) and Elliot *et al.* (1979), in **Bikaneri, Bannur and Perendale sheep, respectively. The estiamte of 0.26 obtained between birth weight and six months weight was lower than average of three estimates (0.67) reported by Ragab *et al.* (1953), Urala (1978) and Singh *et al.* (1984), with a range of 0.51 to 0.82. Chopra and Acharya (1971) however reported a smaller and negative estimate (- 0.07) for the two traits.** The only available estimate to which the coefficient of 0.19 obtained for birth weight and nine month weight can be related is negative (Urala, 1978). The estimate of 0.33 for birth weight and yearling weight compared favourably with 0.32 and 0.37 reported by Fahmy *et al.* (1968), and Urala (1978) for Barki and Bannur sheep, respectively.

Estimates for weaning and post-weaning weights in the present study were much lower than reported values (Radomska and Klewieç, 1975; Elliot *et al.* (1979), Singh *et al.* (1984), and showed a tendency to decline as the period intervening the weights being related increased, with few exceptions. Acharya and Malik (1971) and Chopra and Acharya (1971) observed a similar trend. This can be attributed to large maternal environmental influence on the weight of lamb at weaning and smaller data size cause by frequent transfers of lambs from the flock to other experiments from weaning till yearling.

Phenotypic correlation

The estimate of 0.17 for coefficient of phenotypic correlation for birth and weaning weights was very close to reported values (Karam, 1959; Butcher *et al.* (1964), Morsy and

TABLE 3. COEFFICIENTS OF GENETIC AND PHENOTPIC CORRELATIONS BETWEEN WEIGHT (KG) AT FIVE STAGES

	Birth	Weaning	Six-months	Nine-months	Yearling
Birth		0.10 ± 0.29	0.26 ± 0.30	0.19 ± 0.34	0.33 ± 0.51
Weaning	0.17		0.27 ± 0.20	0.17 ± 0.22	0.08 ± 0.37
Six-months	0.18	0.43		0.14 ± 0.25	0.04 ± 0.42
Nine-months	0.14	0.39	0.33		0.18 ± 0.14
Yearling	0.12	0.27	0.47	0.33	

Above diagonal are genetic correlations and below diagonal phenotypic correlations.

Karam, 1967; Haider and Shah, 1974) in Rahmani, Southdown, Texel and Bibrik sheep respectively. Other workers including Kassab and Karam (1961), Gjedrem (1967), Vesely et al. (1970), Milosavljevic (1971(, Purushotam (1978) and Raman et al. (1981), reported higher estimates of the coefficient (0.29 - 0.98). The estimate of 0.18 obtained for birth and six month weight in the present study was much lower than 0.43 reported by Buvanendran et al. (1981), using the same breed. The same authors however reported a similar estimate for correlation between the two body weight traits in Uda sheep. The estimate was also very close to values reported by Dzakuma et al. (1978), in Hampshire and Bannur sheep, respectively. The lowest correlation coefficient of 0.12 was found for birth and yearling weights. Karam (1959) reported similar trend in Rahmani sheep.

The present analysis yielded a lower coefficient of correlation (0.43) for weaning and six month weight than 0.71 earlier reported in the same breed (Buvanendran et al. (1981), and 0.55 for the Nigerian Dwarf Sheep (Taiwo et al. (1982). Weaning weight was however found to be more strongly correlated phenotypically with nine and yearling weight than in the latter. The estimate got for six months and yearling weight (0.47) was much lower than the average of values (0.74) reported by Morley (1951), Chopra and Acharya (1971) and Dzakuma et al. (1978) respectivelyin Merino, Bikaneri and Hampshire breeds with a range of 0.70 to 0.78.

Comparing the estimates obtained for both genetic and phenotypic correlations for various body weight pairs in the present study, coefficients of genetic correlation of birth weight with post-weaning weights tended to be higher than those of the corresponding phenotypic correlation. This agreed with Ragab et al. (1953), and Besset et al. (1967), who attributed the finding to the fact that phenotypic correlation contains an environmental component as well as the genetic one, while genetic correlation measures only the additive effect of genes that affect two traits in the same animal plus some epistasis effect. Also lower estimates were obained for genetic correlation between weaning and post-weaning weights compared to those of phenotypic correlation but both agreed in direction.

The magnitude of the coefficients obtained in the present flock indicated that some proportion of genetic gain from selection on weaning weight might be carried on to weights at six and nine months of age. Larger data set would however be required to validate this in the Yankasa sheep.

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