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RESEARCH ARTICLE

GENETIC AND PHENOTYPIC PARAMETERS FOR BODY WEIGHTS OF SHAMI KIDS IN ERBIL-KRG-IRAQ

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ABSTRACT

Body weights at birth (BWT), 1(WT1M), 2(WT2M), 3(WT3M), 4(WT4M), 5(WT5M) and 6(WT6M) months of age for 110 Shami kids born at Shami Breeding Station/ Qushtapa during Sep. 2011- Mar. 2012 were utilized. Overall means of BWT, WT1M, WT2M, WT3M, WT4M, WT5M and WT6M were 4.05, 8.38, 13.28, 16.72, 19.77, 23.61 and 26.34 kg, respectively. Results revealed that age of doe had a significant effect on BWT, WT2M, and WT6M. Season of kidding affects BWT and WT4M significantly (P<0.01). The effects of sex of lamb and weight of doe at kidding on all studied traits were not significant. Effect of type of birth was significant (P<0.01) on BWT only. Regressions of WT1M, WT2M, WT3M, WT4M, WT5M and WT6M on BWT, WT1M, WT2M, WT3M, WT4M and WT5M were all significant (P<0.01) and being 1.219, 0.854, 0.988, 1.034, 1.164 and 0.994 kg/kg, respectively. Repeatability estimates for BWT, WT1M, WT2M, WT3M, WT4M, WT5M and WT6M were 0.61, 0.55, 0.54, 0.53, 0.47, 0.42 and 0.44, respectively. The corresponding estimates of heritability were 0.49, 0.44, 0.43, 0.38, 0.28, 0.25 and 0.25, respectively. Genetic correlations between studied traits were positive and ranged between 0.36 (BWT with WT6M) and 0.76 (WT4M with WT5M). Most of the phenotypic correlations between body weights were higher than genetic correlation and ranged between 0.48 and 0.90. It was concluded that estimated genetic parameters for the studied traits were relatively high; therefore, there is a possibility to improve the traits by selection.

INTRODUCTION

Shami goat are known as a productive breed and growth of their kids from birth to marketing age or for replacement is traits of great economic importance and required particular attention for increasing total goat productivity (Hermiz, 2001). Although weight is an important objective in selection, the potential for genetic improvement is largely depend on the genetic and phenotypic parameters of this trait upon which selection may be applied (Mavrogenis *et al.,* 1984 and Das *et al.,* 1996). Moreover, environmental influences can be controlled and corrected to permit more accurate identification of genetic differences between individual goats (Kennedy and Van Vleck, 1992; Hermiz, 1998 and Schaeffer, 2001). This study aimed to study the effects of some genetic and non-genetic factors on kid body weights from birth to 6 months of age and to estimate genetic and phenotypic parameters among them in Shami kids.

MATERIALS AND METHODS

Data utilized in this study were obtained from Shami kids born at Shami Breeding Station/ Qushtapa-Erbil, Northern Iraq (private sector) during Sep. 2011- Mar. 2012. Body weights of 110, 92, 72, 71, 71, 70 and 70 kids were measured at birth (BWT), 1(WT1M), 2(WT2M), 3(WT3M), 4(WT4M), 5(WT5M) and 6(WT6M) months of age, respectively. The animals were allowed to graze natural pasture and stubbles, straw was provided whenever required. Sponges were used to synchronize the mating season. Does were flushed 2 weeks prior to the mating season, and 4 weeks prior to the kidding season as well as during the suckling period. The flock was placed on a regular health program including vaccination, drenching and dipping. New born kids were weighted within 24 hours after birth. Date of birth, body weight and age of doe at kidding, sex of kid and type of birth were recorded. Kids were left with their dams till weaning (3 months) and their monthly body weights till marketing age at 6 months were recorded. The analysis was carried out using General Linear Model (SAS, 2005) and Restricted Maximum Likelihood-REML (Patterson and Thompson, 1971) methods for estimate Best Linear Unbiased Estimates (BLUE) of fixed effects and variance component of random effects respectively. The fixed effects included in the mixed model were age of doe, season of kidding, sex of kid and type of birth, doe weight at kidding and earlier weights on later weights as a covariate. Genetic parameters and repeatability for the studied traits were estimated from the random variations caused by sire (4 bucks) or doe (42 doe).

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Variance and covariance matrices were constructed from sire and error variance and covariance components for each trait and tested for positive definiteness. The non-positive definite matrices were modified using the "Bending" procedure recommended by Hayes and Hill (1981) in order to obtain reliable estimates of the genetic parameters.

RESULTS AND DISCUSSION

The overall means of BWT, WT1M, WT2M, WT3M, WT4M, WT5M and WT6M were 4.05±0.11, 8.38±0.23, 13.28±0.32, 16.72±0.34, 19.77±0.36, 23.61±0.45 and 26.34±0.18 kg, respectively (Tables 2 and 3).

Table 1. Mean squares for the factors affecting body weights of Shami kids from birth to six months of age

Effects	BWT		WT1M		WT2M		WT3M		WT4M		WT5M		WT6M	
	d.f.	Mean Square	d.f.	Mean Square	d.f.	Mean Square	d.f.	Mean Square	d.f.	Mean Square	d.f.	Mean Square	d.f.	Mean Square
Age of doe	3	3.49 **	3	2.64	3	7.95 *	3	4.66	3	1.13	3	6.05	3	8.37 *
Season of kidding	1	7.54 **	1	1.50	1	0.74	1	4.85	1	12.14 **	1	8.61	1	0.06
Sex	1	0.39	1	10.80	1	0.45	1	3.15	1	0.04	1	13.05	1	0.03
Type of birth	2	9.96 **	2	7.75	2	6.30	2	5.50	2	2.82	2	7.46	2	0.80
Regression on: weight of doe at kidding:	1	0.29	1	8.11	1	0.78	1	0.15	1	1.17	1	1.26	1	1.82
Earlier weight			1	82.8 **	1	193.9 **	1	362.2 **	1	547.5 **	1	796.3 **	1	982.2**
Residual	101	0.63	82	3.38	62	2.87	61	2.45	61	1.69	60	3.29	60	2.49

** $P<0.01$ * $P<0.05$

Table 2. Least-square means ± standard errors for the factors affecting body weights from birth till weaning (kg) in Shami kids

Factors	BWT		WT1M		WT2M		WT3M	
	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ±S.E.
Overall mean	110	4.05 ± 0.11	92	8.38 ± 0.23	72	13.28 ± 0.32	71	16.72 ± 0.34
Age of doe (years):								
< 2	30	3.47 ± 0.20 b	28	8.55 ± 0.53 a	23	13.11 ± 0.59 ab	23	16.55 ± 0.55 ab
3	35	3.59 ± 0.15 b	31	8.16 ± 0.39 a	26	12.40 ± 0.40 b	26	16.12 ± 0.38 b
4	30	3.96 ± 0.15 b	20	7.66 ± 0.45 a	13	13.16 ± 0.55 ab	12	16.17 ± 0.52 b
5 <	15	4.64 ± 0.22 a	13	8.50 ± 0.60 a	10	14.39 ± 0.63 a	10	17.66 ± 0.59 a
Season of kidding:								
Winter	65	4.24 ± 0.13 a	54	8.41 ± 0.40 a	52	13.43 ± 0.44 a	51	16.19 ± 0.40 a
Autumn	45	3.59 ± 0.12 b	38	8.03 ± 0.33 a	20	13.10 ± 0.41 a	20	17.06 ± 0.38 a
Sex :								
Male	55	3.98 ± 0.11 a	50	8.60 ± 0.29 a	38	13.35 ± 0.31 a	37	16.85 ± 0.29 a
Female	55	3.85 ± 0.12 a	42	7.84 ± 0.34 a	34	13.18 ± 0.38 a	34	16.40 ± 0.34 a
Type of birth :								
Single	34	4.41 ± 0.14 a	28	8.96 ± 0.38 a	22	14.08 ± 0.40 a	22	16.79 ± 0.38 a
Twin	57	4.26 ± 0.12 a	49	8.20 ± 0.32 a	43	13.28 ± 0.35 a	42	17.38 ± 0.32 a
Triple	19	3.08 ± 0.20 b	15	7.49 ± 0.63 a	7	12.43 ± 0.78 a	7	15.70 ± 0.72 a
Regression on weight of doe at kidding:	110	0.008 ± 0.003	92	0.047 ± 0.03	72	0.017 ± 0.03	71	0.008 ± 0.03
Earlier weight			92	1.219 ± 0.25	72	0.854 ± 0.10	71	0.988 ± 0.08

Means not having a common letter within each column differ significantly ($P<0.05$).

Table 3. Least-square means ± standard errors for the factors affecting body weights at 4, 5 and 6 months of age (kg) in Shami kids

Factors	WT4M		WT5M		WT6M	
	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.
Overall mean	71	19.77 ± 0.36	70	23.61 ± 0.45	70	26.34 ± 0.18
Age of doe (years):						
< 2	23	19.75 ± 0.46 a	23	23.58 ± 0.65 a	23	26.26 ± 0.56 ab
3	26	19.40 ± 0.32 a	25	24.57 ± 0.47 a	25	25.81 ± 0.38 c
4	12	19.22 ± 0.43 a	12	23.61 ± 0.61 a	12	27.69 ± 0.52 a
5 <	10	19.99 ± 0.50 a	10	22.79 ± 0.72 a	10	26.39 ± 0.61 ab
Season of kidding:						
Winter	51	20.27 ± 0.34 a	51	24.25 ± 0.48 a	51	26.49 ± 0.42 a
Autumn	20	18.91 ± 0.31 b	19	23.02 ± 0.47 a	19	26.59 ± 0.42 a
Sex :						
Male	37	19.62 ± 0.24 a	36	24.10 ± 0.34 a	36	26.56 ± 0.30 a
Female	34	19.56 ± 0.28 a	34	23.17 ± 0.40 a	34	26.51 ± 0.35 a
Type of birth :						
Single	22	19.05 ± 0.31 a	22	23.16 ± 0.42 ab	22	26.29 ± 0.36 a
Twin	42	19.64 ± 0.27 a	41	22.81 ± 0.39 b	41	26.65 ± 0.34 a
Triple	7	20.08 ± 0.60 a	7	24.94 ± 0.82 a	7	26.67 ± 0.68 a
Regression on weight of doe at kidding:	71	0.021 ± 0.02	70	0.022 ± 0.03	70	0.026 ± 0.03
Earlier weight	71	1.034 ± 0.06	70	1.164 ± 0.07	70	0.994 ± 0.05

Means not having a common letter within each column differ significantly ($P<0.05$).

Results revealed that age of doe had a significant effect on BWT (P<0.01), WT2M (P<0.05), and WT6M (P<0.05). The increase in birth weight as such is related to the increase in uterine size associated with advancing age of the doe (Owen, 1976). However, Age of doe was found to have no significant effect on WT1M, WT3M, WT4M and WT5M. Similar results were reported earlier (Horst *et al.,* 1993; Das *et al.,* 1996; Hermiz, 2001 and 2005 and Hermiz *et al*., 2008). Tables 2 and 3 revealed that kids born in winter had significantly higher BWT and WT4M (P<0.01) than those born in autumn season. This result confirms others (Nagbal and Chawla, 1984; Wilson, 1987; Horst *et al.,* 1993 and Hermiz *et al*., 2008). The significant effect of season of kidding on body weights reflects the differences in the availability of quality and quantity of feeds. Although the differences between males and females were not significant in their body weights at all studied traits, but males had heavier weights than females at all ages (Tables 2 and 3). Sex differences can be attributed to hormonal differences between them and their resultant effects on growth (Owen, 1976). Such results were noticed by Nagpal and Chawla (1984), Blackburn and Field (1990) and Gebrelul *et al.* (1994). Effect of type of birth was significant (P<0.01) on BWT only (Table 1). In general, kids body weights decreased as litter size increase due to the existence of competition between twins in utero within litters (Donald and Purser, 1956; Burfening, 1972 and Alkass *et al*., 1996). Heaviest weights of single births at later weights in comparison with twin and triple births could be related to their weights at birth (Robinson *et al*., 1977). Such findings are in agreement with other workers (Mavrogenis *et al*., 1984; Malik *et al*., 1986; Wilson, 1987; Ruvuna *et al*., 1988; Horst *et al*., 1993; Gebrelul *et al*., 1994; Das *et al*., 1996 and Hermiz *et al*., 2008). The effects of weight of doe at kidding on all studied traits were not significant (Table 1) with regression coefficients of 0.008, 0.047, 0.017, 0.008, 0.021, 0.022 and 0.026 kg/kg, respectively (Tables 2 and 3). The non significant effect of doe weight at kidding is similar to that reported by Said *et al.* (1990). Regressions of WT1M, WT2M, WT3M, WT4M, WT5M and WT6M on BWT, WT1M, WT2M, WT3M, WT4M and WT5M were all significant (P<0.01) and being 1.219, 0.854, 0.988, 1.034, 1.164 and 0.994 kg/kg, respectively (Tables 1, 2 and 3). Such results were recorded earlier (Hermiz, 2001).

Repeatability estimates for BWT, WT1M, WT2M, WT3M, WT4M, WT5M and WT6M were 0.61, 0.55, 0.54, 0.53, 0.47, 0.42 and 0.44, respectively. The corresponding estimates of heritability were 0.49, 0.44, 0.43, 0.38, 0.28, 0.25 and 0.25, respectively (Table 4).

Table 4. Genetic and phenotypic parameters for body weights of kids

	BWT	WT1M	WT2M	WT3M	WT4M	WT5M	WT6M
BWT	0.49	0.53	0.51	0.48	0.40	0.44	0.36
WT1M	0.61	0.44	0.40	0.48	0.58	0.45	0.47
WT2M	0.60	0.51	0.43	0.62	0.60	0.48	0.45
WT3M	0.55	0.68	0.78	0.38	0.55	0.46	0.61
WT5M	0.63	0.73	0.65	0.90	0.28	0.76	0.45
WT5M	0.58	0.53	0.54	0.61	0.60	0.25	0.69
WT6M	0.55	0.49	0.48	0.68	0.62	0.76	0.25
Repeatability	0.61	0.55	0.54	0.53	0.47	0.42	0.44

The values on, above, and below the diagonal are estimates of heritability, genetic and phenotypic correlations among traits respectively.

The repeatability estimate of BWT was higher than those reported by Wilson (1987), Das *et al.* (1996) and Hermiz *et al.* (2008), while, the repeatability estimate of WT3M was lower than the estimate of Hermiz *et al.* (2008). The estimate of WT6M was moderate and within the range reported by Wilson (1987), Das *et al.* (1996), Hermiz (2001) and Hermiz *et al.* (2008). Heritability estimates obtained in this study for BWT, WT3M and WT6M were moderate and within the range reported by Mavrogenis *et al.* (1984), Das *et al.* (1996), Els (1998), Mourad and Anous (1998), Neopane and Pollott (1998), Hermiz (2001) and Hermiz *et al*. (2008). Increasing heritability estimates with advancing age indicating that mothering ability decreases gradually (Chopra and Acharya, 1971). Genetic correlations between studied traits were positive and ranged between 0.36 (BWT with WT6M) and 0.76 (WT4M with WT5M). Most of the phenotypic correlations between body weights were higher than genetic correlation and ranged between 0.48 and 0.90. Such estimates indicate that there is no genetic antagonism among the traits and the genes responsible for the phenotypic expression of weights at any age were also responsible for the expression of weights at other ages. Hence selection, on the basis of one trait will be expected to cause a positive correlated response to other traits. Similarly, Mavrogenis *et al.* (1984), Mourad and Anous (1998), Neopane and Pollott (1998), Hermiz (2001) and Hermiz *et al*. (2008) found positive genotypic and phenotypic correlations between weights at different ages.

Conclusion

It was concluded that fixed effects need to be adjusted before estimating genetic parameters in order to perform unbiased comparisons between kids. Positive and high estimates of genetic parameters at early ages indicate that selection of kids depending on their early body weights will improve their body weights at later ages. Hence selection, on the basis of one trait will be expected to cause a positive correlated response to other traits. Restricted Selection Index recommended to be used with focusing on body weight of kid at weaning and six month of age with restriction on birth weight to avoid the dystocia and increase their body weights at marketing.

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