



*Supplement of*

## **Comparison of different models for estimation of direct and maternal genetic parameters on body weights in Awassi sheep**

**Hatice Hızlı et al.**

*Correspondence to:* Hatice Hızlı ([hatice.hizlibostan@tarimorman.gov.tr](mailto:hatice.hizlibostan@tarimorman.gov.tr))

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Tablo 1. The data structure of BW, WW for Awassi lambs

Item	Traits	
	BW	WW
Mean	4.15	24.42
SD	0.69	2.65
SE	0.007	0.029
CV	16.5	10.83
Min	2.24	17.42
Max	6.06	31.3
no of records	8142	7647
No of valid records	8142	7647
No of lamb	8142	7647
No of ram	249	243
No of sheep	2416	2360

SD: standard deviation, SE: Standart Error, CV: Coefficient of variance, Min: minimum and Max: Maximum

5 Tablo 2. The least-squares means (LSM) and standard errors (SE) of gender, birth type, year, and age of dam effects for Awassi lambs' BW and WW

Fix effects	BW/kg		WW/kg	
	N	LSM ± SE	N	LSM ± SE
	8142	3.87 ± 0.01	7647	24.49 ± 0.57
Gender				
Female	3980	4.07 ± 0.01	3885	24.17 ± 0.04
Male	4162	4.23 ± 0.01	4062	24.65 ± 0.04
p		< 0.001		< 0.001
Birth type				
Single	7534	4.20 ± 0.01	7354	24.40 ± 0.03
Twin	608	3.55 ± 0.03	593	24.61 ± 0.12
p		< 0.001		<0.001
Year				
2015	2069	4.11 ± 0.01 <sup>b</sup>	2020	24.33 ± 0.06 <sup>b</sup>
2016	3088	4.15 ± 0.01 <sup>a</sup>	3014	24.33 ± 0.05 <sup>b</sup>
2017	2985	4.18 ± 0.01 <sup>a</sup>	2913	24.57 ± 0.05 <sup>a</sup>
p		< 0.001		< 0.05
Age of dam				
b	b (Age of dam)	-0.041±0.005	b (BW)	1.20 ± 0.04 <sup>a</sup>
2			1388	24.44 ± 0.07 <sup>b</sup>
3			1609	24.47 ± 0.06 <sup>b</sup>
4			1989	24.71 ± 0.06 <sup>a</sup>
5			1231	24.18 ± 0.07 <sup>c</sup>
6			1058	24.00 ± 0.08 <sup>c</sup>
7			672	24.51 ± 0.1 <sup>ab</sup>
p		<0.001		<0.001
R Squared		0.09		0.11

Table 3. Estimates of (co)variance components and genetic parameters for BW of Awassi lambs obtained in different models (mean  $\pm$  standard error)

Trait	Models					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
BW						
$\sigma_a^2$	0.12	0.117	0.115	0.117	0.117	0.116
$\sigma_e^2$	0.38	0.368	0.37	0.368	0.369	0.385
$\sigma_p^2$	0.5	0.5	0.5	0.5	0.5	0.49
$\sigma_m^2$		0.015	0.015		0.0073	0.016
$\sigma_c^2$				0.0145	0.0073	0.001
$\sigma_{am}$			-0.013			-0.029
$h_a^2$	0.240 $\pm$ 0.03	0.234 $\pm$ 0.03	0.230 $\pm$ 0.03	0.234 $\pm$ 0.027	0.234 $\pm$ 0.027	0.237 $\pm$ 0.028
$h_m^2$		0.030 $\pm$ 0.014	0.030 $\pm$ 0.014		0.015 $\pm$ 0.001	0.033 $\pm$ 0.150
$h_c^2$				0.030 $\pm$ 0.014	0.015 $\pm$ 0.014	0.002 $\pm$ 0.151
$h_T^2$	0.240	0.249	0.206	0.234	0.241	0.164
$C_{am}$			-0.026			-0.059
$r_{am}$			-0.299			-0.294
LogL	-1175.34	-1172.38	<b>-1171.73</b>	-1173.02	-1173.02	-1171.79
AIC	2354.68	<b>2350.76</b>	2351.46	2352.04	2354.04	2353.58
BIC	<b>2368.68</b>	2371.76	2379.48	2373.06	2382.06	2388.6
$\chi^2_{A1-A2, \dots, A6}$	-	5.92*	7.22*	4.64*	4.64	7.10

- $\sigma_a^2$ : direct additive genetic variance;  $\sigma_m^2$ : maternal additive genetic variance;  $\sigma_{am}$ : direct-maternal genetic covariance;  $\sigma_c^2$ : maternal permanent environmental variance;  $\sigma_e^2$ : error variance;  $\sigma_p^2$ : phenotypic variance;  $h_a^2$ : direct heritability;  $h_m^2$ : maternal heritability;  $C_{am}$ :  $\sigma_{am} / \sigma_p^2$ ;  $r_{am}$ : genetic correlation between direct and maternal effects;  $h_c^2$ :  $\sigma_c^2 / \sigma_p^2$  maternal permanent environmental variance as proportion of phenotypic variance;  $h_T^2$ : Total heritability:  $(\sigma_a^2 + 0.5\sigma_m^2 + 1.5\sigma_{am}) / \sigma_p^2$ ;  $\chi^2 = -2 * \text{Loglikelihood}_{(reduced)} - \text{Loglikelihood}_{(full)}$ ; \*: Test value is significantly at the 0.05 level.

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25 Table 4. Estimates of (co)variance components and genetic parameters for WW of Awassi lambs obtained in different models (mean  $\pm$  standard error)

Trait	Models					
WW	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$\sigma_a^2$	440.08	439.73	438.37	437.80	437.29	285.79
$\sigma_e^2$	2175.20	2066.10	2045.30	2052.20	2052.60	2212.20
$\sigma_p^2$	2615.30	2614.80	2630.00	2615.70	2615.60	2644.00
$\sigma_m^2$		108.04	122.23		62.836	0.095
$\sigma_c^2$				125.67	62.836	146.055
$\sigma_{am}$			24.10			-0.03
$h_a^2$	0.168 $\pm$ 0.029	0.168 $\pm$ 0.029	0.167 $\pm$ 0.029	0.167 $\pm$ 0.029	0.167 $\pm$ 0.029	0.108 $\pm$ 0.023
$h_m^2$		0.041 $\pm$ 0.013	0.050 $\pm$ 0.014		0.024 $\pm$ 0.0001	0.081 $\pm$ 0.183
$h_c^2$				0.048 $\pm$ 0.015	0.024 $\pm$ 0.015	0.055 $\pm$ 0.015
$h_T^2$	0.168	0.168	0.204	0.167	0.179	0.108
$C_{am}$			0.009			0.000
$r_{am}$			0.018			-0.062
LogL	-36029.91	<b>-36024.10</b>	-36024.21	-36024.81	-36024.81	-36035.86
AIC	72063.82	<b>72054.2</b>	72056.42	72055.62	72057.62	72081.72
BIC	72077.82	<b>72075.2</b>	72084.42	72076.64	72085.64	72116.74
$\chi_{A1-A2, \dots, A6}^2$	-	11.62*	11.4*	10.2*	10.2*	11.9*

30  $\sigma_a^2$ : direct additive genetic variance;  $\sigma_m^2$ : maternal additive genetic variance;  $\sigma_{am}$ : direct-maternal genetic covariance;  $\sigma_c^2$ : maternal permanent environmental variance;  $\sigma_e^2$ : error variance;  $\sigma_p^2$ : phenotypic variance;  $h_a^2$ : direct heritability;  $h_m^2$ : maternal heritability;  $C_{am} = \sigma_{am} / \sigma_p^2$ ;  $r_{am}$ : genetic correlation between direct and maternal effects;  $h_c^2 = \sigma_c^2 / \sigma_p^2$  maternal permanent environmental variance as proportion of phenotypic variance;  $h_T^2$ : total heritability:  $(\sigma_a^2 + 0.5\sigma_m^2 + 1.5\sigma_{am}) / \sigma_p^2$ ;  $\chi^2 = -2 * \text{Loglikelihood}_{(reduced)} - \text{Loglikelihood}_{(full)}$  \*: Test value is significantly at the 0.05 level.