THE GENETICS OF MEAT AND MILK PRODUCTION IN TURKISH AWASSI SHEEP

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SUMMARY
Fat-tailed sheep are kept extensively throughout west Asia and north and east Africa as a multipurpose species. Records from a large Awassi flock, progeny tested for lamb growth and ewe's milk production and kept under extensive rangeland conditions, were analysed to investigate the genetic relationships between meat and milk traits. Using a sire model on three years of milk records and five years of lamb growth data meat and milk traits had correlations between estimated sire breeding values of between 0.35 and 0.58, depending on the combination of traits analysed. The level of genetic variation found ranged from a heritability of 0.15 to 0.44 for growth traits and 0.11 to 0.26 for milk traits.
Keywords: Awassi, genetic parameters, meat, milk

INTRODUCTION
Fat-tailed sheep are characteristic of the extensive systems of rangeland management found throughout west Asia and north Africa (WANA), and extending down the eastern side of Africa as far as South Africa. The Awassi is a fat-tailed breed found extensively in Southern Turkey, Iraq, Syria, Jordan, and to a lesser extent in some other WANA countries. Epstein (1985) estimates there to be 65 million breeding ewes throughout the WANA region. It is a hardy well adapted breed used to produce a range of products, meat, milk and wool. The production and use of fat-tailed breeds has been reviewed in Galal and Gursoy (1994) and their recording by Pollott (1995).

There is clearly an interest in the relationship between meat, milk and wool production in a multi-purpose breed like the Awassi, particularly under the extensive rangeland production conditions that exist throughout large parts of the WANA region. This paper presents some preliminary results from the flock described by Gursoy *et al.* (1998) on the genetics of growth and milk characters and the relationship between them.

MATERIALS AND METHODS
The flock from which these data were recorded has been described by Gursoy *et al.* (1998). Each year since 1992 a group of about 20 rams has been used as part of a progeny testing regime for meat and milk production. Each ram was mated to about 100 ewes by AI using fresh semen and the performance of their progeny recorded. A new group of rams was used each year, with the exception of four rams imported from Israel, which were used annually until 1995. Data were analysed from ewes lambing in 1993-97.

Mating took place in July/August with consequent lambing in late December to January. Lambs were reared with their ewes until weaning, at approximately 60 days of age, and subsequently transferred to a feedlot for another 60 days. The ewes were then milked twice a day until early August. Ewes were first mated at 18 months of age and the progeny test for milk yield carried out on first lactation records at 2 years. Hence a ram would be progeny tested for growth in six months and for milk production two and a half years later.

Lambs were weighed at birth (BW), weaning (WW), the start (SW), middle (MW) and end (EW) of the feedlot period. Sire and dam of the lambs was recorded, as well as sex and birth type. Ewe's daily milk yield was recorded monthly after weaning and milk yield calculated according to the international standard (ICAR, 1992). In this paper milk yield (MY90) was calculated for a 90-day period between 75 and 165 days of lactation and four test day yields, taken in March to June (TD1 to TD4), were used.

Genetic parameters and breeding values were estimated by REML methods using a sire model. The five milk traits were analysed using a model containing fixed effects for year of production (1995, 1996, 1997), a covariate for date of lambing and the random terms for sire and error. The growth traits were analysed using a model containing fixed effects for year (1993-7), sex of the lamb, birth type and feedlot group, a covariate for age at start of feedlot test and the two random variables sire and error.

RESULTS AND DISCUSSION

Between 1992 and 1996 a total of 78 rams were tested in the flock. The performance of the offspring of these rams is summarised in Table 1. A total of 4126 lambs, having records for all five weights recorded, were used in the analyses from five lambing seasons, 1993-7. Lambs averaged 4.8 ±0.015 kg at birth and grew to 30.1±0.14 kg by the end of the feedlot period, at about five months of age.

Table 1 Number of records analysed, mean and standard deviations of the ten traits analysed (kg)

Trait	*No*	*Mean*	*s.d.*
Birth weight	4126	4.8	0.991
Weaning weight	4126	14.7	2.74
Start weight	4126	20.1	4.75
Mid-weight	4126	25.8	6.61
End weight	4126	30.1	8.85
Lambing date	1219	2nd January	10.6 days
Test day 1	1219	1.22	0.548
Test day 2	1219	1.05	0.505
Test day 3	1219	0.82	0.396
Test day 4	1219	0.69	0.398
90-day milk yield	1219	113	42.4

First lactation records from 1219 ewes, the daughters of 58 rams, were used to analyse milk yield following the three lambings in 1995-7. Mean lambing date was 2nd January. Milk yield at the March test day (TD1) averaged 1.22±0.015 kg and declined to 0.69±0.01kg by the June test day (TD4). Total milk yield over the 90-day period was 113±0.65 kg.

The results of the paternal half-sib REML analysis of the five lamb weight traits are shown in Table 2. Weight at birth (0.44±0.09) was the most heritable of the five traits with weight at weaning (0.15±0.03) and start of the feedlot period (0.14±0.03) being the least heritable. The correlations between the four older weights was high, as expected from this type of study, with the correlation between birthweight and the later weights being moderate to low. Both genetic and phenotypic correlations followed a similar pattern and all parameters were accurately estimated.

Table 2 **Genetic parameters between the five growth traits**

Trait	*BW*	*WW*	*SW*	*MW*	*EW*
BW	0.44 ± 0.09	0.40 ± 0.01	0.36 ± 0.04	0.28 ± 0.02	0.31 ± 0.03
WW	0.52 ± 0.13	0.15 ± 0.03	0.80 ± 0.01	0.64 ± 0.01	0.61 ± 0.01
SW	0.39 ± 0.16	0.93 ± 0.04	0.14 ± 0.03	0.73 ± 0.01	0.62 ± 0.02
MW	0.22 ± 0.16	0.94 ± 0.04	0.98 ± 0.02	0.26 ± 0.06	0.83 ± 0.01
EW	0.42 ± 0.14	0.90 ± 0.04	0.92 ± 0.03	0.93 ± 0.02	0.31 ± 0.06

r_g lower triangle; r_p upper triangle; h^2 on diagonal

The five milk yield traits were analysed by paternal half-sib analyses and the heritabilities, genetic and phenotypic correlations are shown in Table 3. The four test day yields and 90-day milk yield were low to moderately heritable and highly correlated to each other at the genetic level. The association between the five traits was less marked at the phenotypic level, but nevertheless was strong.

Table 3 **Genetic parameters between the five milk traits**

Trait	*TD1*	*TD2*	*TD3*	*TD4*	*MY90*
TD1	0.22 ± 0.07	0.40 ± 0.02	0.36 ± 0.03	0.034 ± 0.02	0.62 ± 0.02
TD2	0.88 ± 0.14	0.11 ± 0.05	0.46 ± 0.02	0.40 ± 0.02	0.76 ± 0.01
TD3	0.94 ± 0.10	0.99 ± 0.05	0.12 ± 0.06	0.49 ± 0.02	0.78 ± 0.01
TD4	0.86 ± 0.09	0.99 ± 0.04	0.98 ± 0.07	0.26 ± 0.08	0.64 ± 0.02
MY90	0.97 ± 0.04	0.97 ±0.03	0.99 ±0.03	0.96 ± 0.05	0.25 ± 0.08

r_g lower triangle; r_p upper triangle; h^2 on diagonal

Estimated breeding values (EBV) were calculated by BLUP for each of the 78 sires used in the weight analyses and 58 of them for which milk yield information was available on their daughters. Fifty-eight sires thus had ten breeding values, five from the weight analyses and five from the milk yield analyses. The correlation between the five weight and five milk EBV were calculated from these 58 sires and shown in Table 4. Correlation ranged from 0.35 (TD4 with MW) to 0.58 (TD2 with EW). In general, there was a good association between the breeding values for growth and milk production.

Table 4 **Correlations between sire EBV for the five milk and five weight traits**

	TD1	*TD2*	*TD3*	*TD4*	*MY90*
BW	0.51	0.57	0.56	0.57	0.55
WW	0.43	0.46	0.46	0.46	0.45
SW	0.38	0.42	0.41	0.42	0.41
MW	0.37	0.36	0.36	0.35	0.37
EW	0.54	0.58	0.57	0.58	0.56

Sheep meat and milk are both very important products in the WANA region, with very high market values relative to similar products from other species. Since the options for increased output are limited from extensive and semi-intensive sheep systems improved performance from better genetic stock is of major interest. Genetic variation in the traits of interest, in such systems, has commonly been shown to exist in more intensively managed flocks but the question remains about the variation found under rangeland conditions, and its relation the genetic variation in the same trait under intensively managed systems. In this study it has been shown that similar levels of genetic variation exists in this extensively managed Awassi flock as found in more intensively managed sheep flocks. Perhaps of greater interest is the genetic relationship between meat and milk production in sheep. In this study there appears to a good genetic relationship between growth in lambs and milk production, as measured by first lactation 90-day yield. Clearly the genes which influence growth also influence milk production in sheep, or are closely linked.

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