HERITABILITY AND GENETIC CORRELATIONS OF PELT AND SKIN QUALITY TRAITS OF ICELANDIC LAMBS

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SUMMARY

Pelt and skin traits were recorded on live lambs and their pelts before and after tanning to double-face lamb skins. Data were analysed in three data sets, with 1474, 1989 and 550 records respectively. Pooled heritability estimates of subjective scores were: for wool density 0.20; fineness of outer coat fibres 0.31; wool lustre 0.28; pelt thickness 0.16; double leather (a skin fault) on salted pelts 0.27 and double leather on tanned skins 0.58. Estimates from the threshold model were 0.30, 0.46, 0.29, 0.12, 0.44 and 0.63 for the same traits, respectively. Heritability (pooled) of skin size was 0.27, skin weight 0.51 and skin weight per unit area 0.64, all adjusted for carcass weight. Genetic correlations were high and positive between traits scored on salted pelts and related traits scored or measured on tanned skins. Double leather was moderately associated with light and thin skins. It was concluded that pelt and skin quality can be improved by selection, without unfavourable effects on carcass weight.

Keywords: sheep, skin quality, genetic parameters, wool-skins

INTRODUCTION

Sheepskins are mainly used for the production of leather after chemical dehairing but wool-skins or double-face skins are special lamb skin products, that are tanned with a short staple of wool on and mainly used for winter clothing. The quality of the skin is determined by the appearance and strength of the suede surface of the skin, together with the weight and thickness of the tanned wool-skin. Good quality wool-skins are lightweight and soft with a smooth, firm and even surface.

The great majority of lamb pelts from the Icelandic sheep breed are utilised for the production of wool skins. A fault appearing on the flesh side has been observed in the processed skins, as looseness of the skin between the corium and the grain layers, particularly in the area of the rear butt.. The strength of the skin is seriously impaired in the damaged areas and the value of the skin is reduced accordingly. The term "double leather" has been used for this fault by Adalsteinsson (1983). The description corresponds in some respect to double hiding which is a known problem in sheep skins, particularly from Merino sheep, caused by the accumulation of fat between layers in the skin (Tancous 1986).

The objective of the study presented here was estimate the genetic variation of traits that might affect the quality of tanned wool skins made from Icelandic lamb pelts, and hence the value of the skins.

MATERIALS AND METHODS

Records on pelt and skin quality traits of autumn lambs were collected from two experimental farms (Hestur (I) and Reykholar (II)) in Iceland for seven years (1984 - 1990) and from eight additional flocks (III) for two years (1984 - 1985). The number of animals with records in each data set was 1471, 1989 and 550 in the three data sets respectively The lambs were generally born in May and grazed together with their dams on mountain pastures from late June until mid- or late September. Live weight and pelt scores were recorded 3 - 4 days prior to slaughter in late September/early October. Carcass weight was recorded at slaughter. Quality traits on pelts and skins were recorded on salted pelts prior to tanning and on tanned skins.

Variance components were estimated by the method of derivative free REML, using the DFREML programs (Meyer 1993), fitting an animal model and including all available pedigree information. Environmental effects considered in the analysis included year, sex and age of lamb and live weight or carcass weight, depending on time of recording of the trait analysed. A threshold model was also fitted to all subjectively scored traits and variance components estimated with the method proposed by Gianola and Foulley (1983), utilising the computing technique given by Misztal *et al.* (1989). The three data sets were analysed separately and the results pooled afterwards.

RESULTS AND DISCUSSION

Means and standard deviations for the traits measured are shown in Table 1.

Table 1. Means and standard deviations of wool and skin traits and covariates

	Data set I		Data set II		Data set III	
Trait	Mean	SD	Mean	SD	Mean	SD
Wool density (1-5)	3.16	0.76	3.59	0.74	3.11	0.74
Wool fineness (1-5)	2.85	0.69	2.81	0.74	3.36	0.81
Wool lustre (1-5)	2.91	0.71	3.54	0.72	3.20	0.82
Pelt thickness (1-3)	2.11	0.52	2.25	0.52	1.96	0.50
Double leather A[a)] (0-1)	0.56	0.50	0.54	0.50	0.32	0.50
Double leather B[a)] (0-4)	2.17	1.41	2.27	1.31	2.15	1.38
Size of skin (dm^2)	64.8	7.55	74.6	9.10	70.9	8.35
Weight of skin (g)	485.9	87.6	583.8	111.2	547.9	105.6
Skin wt./area, (g/dm^2)	7.47	0.86	7.79	0.89	7.69	0.88
Covariates:						
Age of lamb (days)	134.8	9.02	131.1	9.05	-	-
Live weight (kg)	37.9	5.42	39.4	6.22	39.1	5.52
Carcass wt. (kg)	15.7	2.52	16.0	2.82	15.6	2.88

a) A: salted pelts; B: tanned wool-skins

Distribution of scores was comparable between data sets. There was a marked difference in size and weight of skins between the two experimental flocks (Data sets I and II), which was only partly reflected in live weight differences. The incidence of double leather in tanned wool-skins was high, with less than 20 % of all skins without damage.

Environmental effects explained 10 - 36 % of the variation in scores for wool traits, 23 - 46 % of the variation in pelt and skin thickness (g/dm^2), 53 - 61 % and 64 - 75 % of the variation in size and weight of skin, respectively. Weight of lamb was the dominating factor affecting these traits. Scores for double leather were little affected by environmental effects ($R^2 < 10$ %).

Table 2. Heritabilities, with standard errors, of wool and skin traits and genetic coefficient of variation (range from three data sets), estimates are pooled from analyses of three data sets

	Animal model			Threshold model	
Trait	h^2	SE	CV_A (%)	h^2	SE
Wool density (1-5)	0.20	0.07	8 - 9	0.30	0.06
Wool fineness (1-5)	0.31	0.05	12 - 15	0.46	0.07
Wool lustre (1-5)	0.28	0.06	8 - 12	0.29	0.06
Pelt thickness (1-3)	0.16	0.04	5 - 12	0.12	0.03
Double leather[a)] A (0-1)	0.27	0.04	43 - 55	0.44	0.06
Double leather[a)] B (0-4)	0.58	0.05	31 - 46	0.63	0.07
Size of skin (dm^2)	0.27	0.05	4		
Weight of skin (g)	0.51	0.06	4 - 9		
Skin wt./area (g/dm^2)	0.64	0.06	5 - 8		

a) A: salted pelts; B: tanned wool-skins

The pooled heritabilities from the three data sets are shown in Table 2. The heritabilites were intermediate or high for most of the pelt and skin traits, highest for the double leather score on tanned skins and skin weight pr. unit area. Since most of the traits were adjusted for weight of lamb, the heritabilities express genetic variation at equal weights. Estimates of heritability from the threshold model were higher than the animal model estimates for most traits. Similar values were, however, obtained by both methods for wool lustre score and pelt thickness score.

Most heritability estimates were similar or higher than earlier results for the traits (Adalsteinsson 1983). The genetic coefficients of variation were quite high for both scores for double leather , which is in accordance with the lack of environmental effects on this trait. Studies on genetic variation of skin faults comparable to double leather are not available for other breeds of sheep. The strong genetic control of this fault in the Icelandic breed may point towards a structural fault in the skin. A structural fault, termed vertical fibre hide defect, has been described in cattle hides, that is caused by a single recessive gene (Cundiff *et al.* 1987).

Table 3. Genetic correlations (with standard errors) between traits recorded on tanned wool-skins and all traits studied, estimates are pooled from analyses of three data sets

	Double leather[a)] B	Size of skin	Weight of skin	Skin wt/area g/dm^2
Wool density	0.11 (0.08)	0.42 (0.13)	0.39 (0.10)	0.27 (0.09)
Wool fineness	0.13 (0.10)	-0.39 (0.12)	-0.57 (0.10)	-0.37 (0.10)
Wool lustre	0.19 (0.12)	0.36 (0.12)	-0.14 (0.12)	-0.26 (0.12)
Pelt thickness	0.06 (0.11)	0.60 (0.11)	0.89 (0.06)	0.61 (0.10)
Double leather[a)] A	0.85 (0.04)	-0.01 (0.12)	-0.30 (0.10)	-0.30 (0.09)
Double leather[a)] B	-	0.34 (0.09)	-0.18 (0.08)	-0.40 (0.07)
Size of skin	-	-	0.31 (0.09)	-0.27 (0.10)
Weight of skin	-	-	-	0.86 (0.02)
Carcass weight[b)]	-0.24 (0.12)	0.65 (0.14)	0.63 (0.11)	0.24 (0.13)

a) A: salted pelts; B: tanned wool-skins b) direct additive component

The genetic correlations (Table 3) between scores for wool traits and skin traits showed little association of wool traits with double leather while dense and coarse wool was associated with heavy and thick skins. Predictions of pelt thickness and double leather damage by subjective scoring of salted pelts were shown to be useful. Damage due to double leather was found to be more frequent in large and thin skins, which is rather unfavourable since the industry prefers light and soft skins. Genetic correlation between carcass weight and score for double leather was moderately low and favourable. Phenotypic correlations were lower than their genetic counterparts and with the same sign.

The prospects of genetic improvement of skin quality are good in view of the presented results, but high costs of measurement of traits that have to be assessed on processed skins will be a drawback. Evaluation of salted pelts proved useful in the study, and judgement of raw pelts may reduce the time lag and costs involved. Further research is needed to reveal the nature of double leather which is the most important trait for skin quality.

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