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LACK OF EVIDENCE FOR STATE OF PREGNANCY EFFECTS ON SCAN RECORDS OF HEIFERS

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SUMMARY

Records for fat depth and eye muscle area, measured by ultrasound scanning of live Angus and Hereford heifers were analysed including and excluding a state of pregnancy effect. Pregnancy status measured as "days until calving" and age at scanning were sufficiently correlated (-0.7 to -0.8) for the effects of age at recording and contemporary group in the model of analysis to account for any pregnancy status effects. Hence estimates of variance components and genetic parameters from both analyses were virtually identical. Results indicate that a separate correction for pregnancy status when using ultrasound scanning records on heifers as auxiliary information in genetic evaluation for carcass traits is unnecessary.

Keywords: Pregnancy status, ultrasound scanning, beef cattle, genetic evaluation.

INTRODUCTION

Live ultrasound scan records for heifers and steers taken between 300 and 700 days of age comprise a major source of information for the genetic evaluation of carcass traits under BREEDPLAN. Records for both bulls and heifers or steers are utilised, albeit treated as separate traits, with fat depth measurements on heifers and steers more heritable and thus more informative than for bulls (Meyer and Graser 1999). With a mean age at scanning around 500 days, heifers are generally in calf, and there has been concern that differences in stage of gestation - which are currently not taken into account - might affect comparisons between animals. This paper investigates 'pregnancy status' effects on scan records for Australian Angus and Hereford heifers.

MATERIAL AND METHODS

***Data*.** Records for eye muscle area (EMA; cm^2), P8 fat depth (P8; mm), fat depth at the $12^{th}/13^{th}$ rib (RIB; mm), and weight at scanning (SWT; kg) for Angus and Hereford or Polled Hereford heifers were extracted from the National Beef Recording Scheme (NBRS) data base. After basic edits, only measurements for heifers aged 300 to 700 days with subsequent calving dates between 0 and 310 days after scanning were retained. Pregnancy status was then determined as the difference between calving and scanning dates, i.e. as days before or until calving, with a low numeric value describing a heifer scanned in late gestation.

***Analysis*.** Univariate restricted maximum likelihood analyses were carried out in- and excluding pregnancy status as a linear and quadratic covariable. Other fixed effects in the model of analysis were contemporary groups (CG), defined as herd-management group-scanning date subclasses, birth type (single versus twin) and the so-called "heifer factor", an age of dam class effect distinguishing

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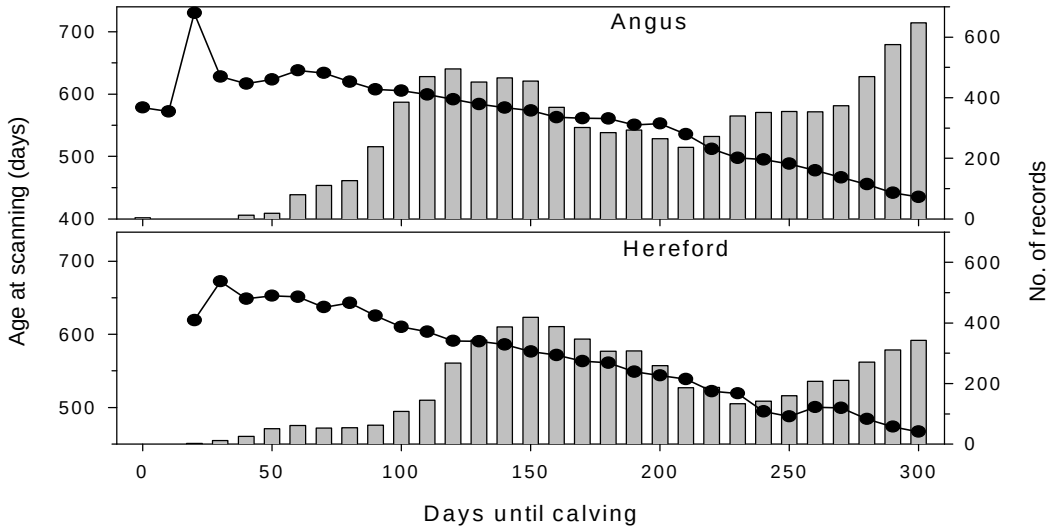

Figure 1. Distribution of number of records (bars) according to pregnancy status (10-day intervals), with mean ages at scanning (●).

between heifers (calving at 28 months or less) and cows. An 'age slicing' of 60 days was applied to CG subclasses, i.e. if the range of ages at scanning within a CG exceeded 60 days, it was subdivided so that only animals at most 60 days differing in age were directly compared with each other. In addition, dam age and age at scanning were fitted as linear and quadratic covariables each. Random effects fitted were animals' direct additive effects and sire x herd interaction effects. No maternal effects were included, as preliminary analyses had shown these to be negligible. For Herefords, estimates of sire x herd effect variances were essentially zero for P8 and RIB and analyses were thus repeated fitting a simple animal model only. All pedigree information available for parents not in the data and their ancestors was incorporated into the analysis, resulting in three to four times as many animals in the analysis as there were records (Table 1).

RESULTS

Characteristics of the data structure are summarised in Table 1. On average, heifers were scanned about 200 days before calving, i.e. in the early stages of gestation. However, corresponding standard deviations were close to 70 days, and as shown in Figure 1, there were substantial numbers of heifers scanned between 200 and 100 days before calving. Also shown are mean ages at scanning for each 10 day interval in days before calving, indicating an almost linear, inverse relationship. Correlations between age at scanning and days until calving were -0.78 for Angus and -0.67 for Herefords. Within CGs, however, there was virtually no association between age at scanning and days before calving, corresponding correlations being reduced to r=0.08 and -0.07, respectively.

Estimates of phenotypic and residual variance components, heritabilities and the proportion of variance due to sire x herd effects (s^2) are given in Table 2. Estimates from analyses ignoring pregnancy status and analyses fitting days until calving as a covariable were virtually the same for

Table 1. Characteristics of the data structure.

	Angus				Hereford			
	P8	RIB	EMA	SWT	P8	RIB	EMA	SWT
No. records	8731	8618	8749	8680	5648	5673	5664	5652
No. animals[1]	25,544	25,544	25,544	25,544	21,720	21,720	21,720	21,720
No. CG[2]	940	938	937	929	697	699	696	692
→ of size 1	207	206	206	202	180	179	178	177
No. S x H[3]	3021	3018	3037	3021	2001	2010	2005	2001
Mean	6.643	4.978	57.25	397.0	7.286	4.649	54.46	394.3
SD	3.511	2.483	8.94	66.4	3.784	2.073	8.23	58.6
Age (days)	532.2	531.9	531.6	531.2	545.1	545.2	545.1	545.4
SD	74.7	75.5	74.9	74.8	65.8	65.8	65.8	65.7
Days until calv.	197.9	198.3	198.4	198.6	195.4	195.5	195.5	195.2
SD	71.1	71.7	71.2	74.8	65.5	65.4	65.3	65.3
Dam age (years)	4.67	4.67	4.67	4.67	4.72	4.72	4.72	4.72
SD	2.27	2.27	2.27	2.27	1.90	1.90	1.91	1.89

[1] in the analysis, including parents without records; [2] contemporary groups; [3] sire x herd interaction effects

Table 2. Estimates of phenotypic variance (σ_P^2), residual variance (σ_E^2), heritability (h^2) and proportion of phenotypic variance due to sire x herd effects (s^2), from analyses including (A) and excluding (B) 'days until calving' as a covariable.

	P8		RIB		EMA		SWT	
	A	B	A	B	A	B	A	B
				Angus				
σ_P^2	4.435	4.465	2.097	2.111	25.66	25.66	757.4	759.0
σ_E^2	2.185	2.174	1.217	1.217	16.22	16.21	330.7	337.7
h^2	0.479	0.486	0.390	0.395	0.354	0.354	0.522	0.513
s.e[1]	.034	.034	.036	.035	.035	.035	.038.	.038
s^2	0.028	0.027	0.030	0.029	0.015	0.015	0.042	0.042
s.e.	.011	.012	.012	.011	.010	.010	.011	.011
				Hereford				
σ_P^2	5.375	5.409	1.861	1.875	30.64	30.65	826.5	832.6
σ_E^2	3.381	3.407	1.257	1.267	19.16	19.23	448.5	464.3
h^2	0.371	0.370	0.325	0.325	0.338	0.335	0.405	0.387
s.e	.044	.044	.042	.043	.045	.046	.046	.046
s^2	-	-	-	-	0.037	0.037	0.052	0.056
s.e.	-	-	-	-	.016	.016	.017	.018

[1] Approximate lower bound sampling error

EMA, RIB and P8. For SWT, analyses accounting for pregnancy status yielded slightly reduced estimates of variances and very slightly increased heritabilities. Differences, however, were well within the range of sampling errors. Results suggested that any pregnancy status effects on scan traits were negligible. Alternatively, the other fixed effects in the model of analysis, in particular age at scanning and contemporary grouping, were sufficiently confounded with days until calving to remove any systematic differences in EMA or fat measurements associated with stage of gestation.

Heritability estimates were higher for Angus than for Herefords and somewhat higher than previous estimates from bivariate analyses treating measurements on heifers or steers and bulls as separate traits (Meyer and Graser 1999). Presumably this was due to considering only the subset of records on heifers which calved subsequently in this study. Heifers in the subset were on average one month (Angus) to one and a half month (Hereford) older than in the larger data sets used previously, and had correspondingly higher means and variances. In turn, this may have allowed greater expression of genetic variation.

CONCLUSIONS

Effects of 'pregnancy status' on ultrasound records for heifers were negligible. Presumably this was at least partially due to confounding with other fixed effects already in the model of analysis, in particular age at scanning and contemporary group effects. This implies that a model omitting any correction for pregnancy status is adequate to model variation scan records for heifers in genetic evaluation.

REFERENCES

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