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ABSTRACT

Relationship between marbling and marbling fineness in Japanese Black Wagyu

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Marbling is becoming increasingly important in breeding objectives of Australian beef producers. This is due to its association with increased meat eating quality. With marbling becoming more desirable there has been a shift in consumer preference towards finer marbled meat (flecks < 0.5cm^2) which is considered more aesthetically pleasing. AUS -MEAT subjectively assesses marbling using visual scoring systems. This method lacks the precision and range to accurately record high marbling phenotypes in Wagyu and only crudely assesses marbling fleck size. Utilisation of objective measures such as the Meat Image Japan (MIJ) camera are likely to increase accuracy so that both marbling and fineness can be improved simultaneously.

A Full-Blood Wagyu dataset consisting of 878 genotyped animals with AUS-MEAT and MIJ camera records was utilised to estimate genetic parameters of traits. Traits of interest (mean ± SD) were hot standard carcass weight (HSCW, 437 ± 47kg), AUS-MEAT P8 site fat depth (P8, 17 ± 7mm), AUS-MEAT marble score (MARB, scale 0-9, 8 ± 1), MIJ rib- eye area (I_REA, 45 ± 8cm2), MIJ percentage marbling (I_MARB, 29 ± 7%), MIJ coarseness of marbling index (I_COURSE, 0.3 ± 0.1%), MIJ percentage marbling minus largest marbling particle (I_MARB2, 27 ± 1%) and MIJ fineness of marbling index (I_FINE, 53 ± 11mm/cm) which is defined as the total circumference of marbling particles (mm) divided by the square root of the rib-eye area. Further definitions and methodology for MIJ camera traits can be found in Kuchida et al. (2006). Estimations of genetic parameters were calculated using mixed model equations in ASReml-R (Butler et al. 2007) with fixed effects of sex (heifer, steer), dam age group (maiden, mature, old), and heterozygosity (21-42%). An additional fixed effect included contemporary group (25 levels), 9 of which had <10 animals with the maximum number being 199. Animals were genotyped with a 30K SNP chip. After filtering for SNPs with a minor allele frequency >0.05, 20955 SNPs were retained to construct the genomic relationship matrix (VanRaden 2008).

Heritabilities were moderate to high for all traits (Table 1). I_MARB was strongly correlated with MARB and given its high heritability, it is likely a superior trait for marbling improvement. Favourable relationships between I_FINE and other traits exist suggesting selection for fineness and marbling combined will not antagonise other important traits. I_COURSE was generally favourably correlated with other traits, but was strongly correlated with I_MARB. However, I_COURSE was lowly correlated with I_FINE suggesting selection on I_FINE will not increase coarseness while selecting for I_MARB might. The results suggest that I_FINE is a better trait for improving marbling than I_MARB and MARB with the added benefit of improving marbling fineness and reducing the appearance of unattractive, coarse marbling particles.

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Table 1. Genotypic correlations (below) and phenotypic correlations (above) between AUS-MEAT carcass traits and Meat image analysis (MIA) traits. Heritability* of traits (SE) is presented on the diagonal

	HSCW	P8	I_REA	I_MARB	I_COURSE	I_FINE	I_MARB2	MARB
HSCW	0.56(0.06)	0.26	0.29	0.07	0.24	0.07	0.06	0.15
P8	0.14	0.37(0.07)	-0.02	0.03	0.08	-0.05	0.03	0.01
I_REA	0.33	-0.05	0.42(0.07)	0.15	0.40	0.39	0.16	0.29
I_MARB	-0.09	-0.04	0.23	0.75(0.05)	0.53	0.69	0.98	0.77
I_COURSE	-0.02	0.12	0.31	0.64	0.51(0.06)	0.01	0.43	0.49
I_FINE	-0.03	-0.23	0.48	0.79	0.18	0.55(0.06)	0.72	0.56
I_MARB2	-0.10	-0.06	0.22	1.00	0.61	0.81	0.74(0.05)	0.77
MARB	-0.05	-0.06	0.33	0.97	0.65	0.83	0.97	0.56(0.06)

*h^2 (se) is an average of bi-variate analyses; genotypic correlations SE 0.0001 – 0.14, phenotypic correlations SE 0.02 – 0.04.

References

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