**Inferring causal structures and comparing the causal effects among calving difficulty, gestation length and calf size in Japanese Black cattle.**

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**Supplementary Table S2.** Posterior means ± posterior standard deviations of the variance components within the traits for the structural equation model fitted for the causal structure in Fig. 2a

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variancecomponent2 | GL1 |  | CD |  | BWT |  | WH |  | CHG |
| $$σ\_{hy}^{2}$$ |  1.14 ± 0.422 |  |  0.15 ± 0.067 |  |  1.70 ± 0.611 |  | 1.28 ± 0.428 |  |  2.43 ± 0.742 |
| $$σ\_{s}^{2}$$ |  2.79 ± 0.564 |  |  0.09 ± 0.041 |  |  2.66 ± 0.591 |  | 1.21 ± 0.272 |  |  1.27 ± 0.320 |
| $$σ\_{mgs}^{2}$$ |  0.98 ± 0.291 |  |  0.23 ± 0.082 |  |  2.89 ± 0.645 |  | 1.11 ± 0.279 |  |  2.15 ± 0.526 |
| $$σ\_{s,mgs}$$ |  1.20\* ± 0.351 |  |  0.02 ± 0.044 |  |  1.88\* ± 0.497 |  | 0.87\* ± 0.227 |  |  1.19\* ± 0.336 |
| $$σ\_{D}^{2}$$ | 11.14 ± 2.254 |  |  0.37 ± 0.165 |  | 10.63 ± 2.366 |  | 4.83 ± 1.088 |  |  5.10 ± 1.279 |
| $$σ\_{M}^{2}$$ |  1.92 ± 0.862 |  |  0.91 ± 0.378 |  |  6.71 ± 2.164 |  | 2.16 ± 0.865 |  |  5.13 ± 1.704 |
| $$σ\_{D,M}$$ | −0.78 ± 1.124 |  | −0.11 ± 0.188 |  |  2.19 ± 1.729 |  | 1.05 ± 0.724 |  |  2.20 ± 1.122 |
| $$σ\_{e}^{2}$$ | 15.42 ± 0.550 |  |  1.00 ± 0.047 |  | 14.93 ± 0.543 |  | 9.33 ± 0.332 |  | 10.63 ± 0.385 |
| $$h\_{D}^{2}$$ |  0.52 ± 0.088 |  |  0.24 ± 0.104 |  | 0.44 ± 0.086 |  | 0.35 ± 0.070 |  | 0.29 ± 0.066 |
| $$h\_{M}^{2}$$ |  0.09 ± 0.040 |  |  0.61 ± 0.230 |  | 0.28 ± 0.087 |  | 0.16 ± 0.061 |  | 0.29 ± 0.091 |
| $$r\_{D,M}$$ | −0.16 ± 0.234 |  | −0.15 ± 0.298 |  | 0.28 ± 0.219 |  | 0.35 ± 0.234 |  | 0.45\* ± 0.222 |

GL = gestation length; CD = calving difficulty; BWT = birth weight; WH = withers height; CHG = Chest girth

1Variance components for GL and CD were averaged from three triplet analyses, which triplets included CD, GL and BWT, WH or CHG; and those for BWT, WH and CHG were from each triplet analysis that included GL and CD.

2$σ\_{hy}^{2}$ = contemporary group variance; $σ\_{s}^{2}$ = sire genetic variance; $σ\_{mgs}^{2}$ = maternal grand sire (MGS) genetic variance; $σ\_{s,mgs}$ = covariance between sire and MGS genetic effects; $σ\_{D}^{2}$ = direct genetic variance; $σ\_{M}^{2}$ = maternal genetic variance; $σ\_{D,M}$ = covariance between direct and maternal genetic effects; $σ\_{e}^{2}$ = residual variance; $h\_{D}^{2}$ = direct heritability; $h\_{M}^{2}$ = maternal heritability; $r\_{D,M}$ = genetic correlation between direct and maternal effect.

\*95% highest posterior density region does not include 0.