Genetic correlations between type traits of young Polish Holstein-Friesian bulls and their daughters

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The objective of this study was to estimate the genetic correlations of conformation traits of Polish Holstein-Friesian bulls and similarly defined type traits of their daughters.

Material and Methods

Data were 7 linearly scored (1–9 scale) and 3 descriptive (scored from 50 to 100) conformation traits of 933 young bulls born between 2005 and 2008, and the same traits evaluated in their 65,479 daughters born between 2007 and 2010. Young bulls were scored at 15 months of age, and their daughters at 28 months, on average.

Models

The linear model for bulls included fixed linear regressions on age at evaluation, fixed effects of herd and classifier, and random additive genetic effect.

The linear model for cows contained fixed effects of herd-year-season-classifier, lactation stage, fixed linear regression on age at calving, and random additive genetic effect.

Method

A two-trait animal model and a Bayesian method via Gibbs sampling were used to estimate (co)variance components. Ten analyses were run, each for one trait scored for bulls and their daughters. Heritabilities and genetic correlations were calculated using estimated components.

Results

Scores for descriptive traits were lower and standard deviations higher for cows than for their sires. For linearly scored traits the means and standard deviations were more or less similar for the two groups of animals.

Estimates of bulls' heritabilities for all analyzed traits ranged from 0.07 for feet and legs to 0.25 for body depth. Heritabilities of cows were lowest for rear legs - rear view (0.05) and foot angle (0.06), and highest for size (0.43).

The genetic correlations between similarly described traits of bulls and their daughters were moderate to high (0.42-0.91). The genetic correlation was lowest for chest width (0.42) and highest for rump angle (0.91).

Conclusions

The magnitude of genetic correlations between pairs of type traits of sires and daughters were sufficiently high to suggest that bulls' own conformation evaluations could contribute to breeding value estimation of bulls based on relatives.

Characteristics of conformation scores

No	Trait	Sires (N = 933)				Cows (N = 65,479)			
		Mean	SD	Min	Max	Mean	SD	Min	Max
1	Size	86.2	4.2	73	97	82.6	4.4	50	94
2	Type and conformation	83.1	2.4	75	96	79.8	3.4	52	89
3	Feet and legs	81.6	2.6	72	90	79.2	3.2	50	89
4	Body depth	6.5	1.0	1	9	6.0	1.2	1	9
5	Chest width	6.0	1.0	2	9	5.2	1.3	1	9
6	Rump angle	4.6	1.1	1	8	5.1	1.2	1	9
7	Rump width	5.5	1.1	3	8	5.5	1.2	1	9
8	Rear legs - side view	5.2	0.7	2	8	5.4	1.1	1	9
9	Foot angle	5.7	1.1	2	9	5.1	1.3	1	9
10	Rear legs - rear view	5.3	1.4	2	9	5.6	1.3	1	9

Heritabilities (h^2_{SIRE} and h^2_{COW}) and genetic correlations (r_g) of conformation traits

No	Trait	h^2_{SIRE}	SD	h^2_{COW}	SD	r_g	SD
1	Size	0.11	0.025	0.43	0.019	0.83	0.046
2	Type and conformation	0.21	0.043	0.24	0.017	0.45	0.122
3	Feet and legs	0.07	0.011	0.07	0.010	0.47	0.166
4	Body depth	0.25	0.034	0.19	0.014	0.65	0.080
5	Chest width	0.12	0.026	0.15	0.013	0.42	0.128
6	Rump angle	0.23	0.036	0.25	0.017	0.91	0.024
7	Rump width	0.08	0.014	0.26	0.018	0.48	0.141
8	Rear legs - side view	0.08	0.024	0.10	0.011	0.80	0.054
9	Foot angle	0.09	0.026	0.06	0.009	0.79	0.061
10	Rear legs - rear view	0.12	0.017	0.05	0.005	0.76	0.044