

Genetic parameters for foot and claw disorders in Czech Holstein cattle

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The authors are fully responsible for both the content and the formal aspects of the electronic supplementary material. No editorial adjustments were made.

Electronic Supplementary Material (ESM)

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<https://doi.org/10.17221/140/2025-CJAS>

Table S1. Lactation incidence (%) for analysed foot and claw disorders by parity; for 90 days in milk or 305 days in milk

Parity	Infectious diseases (%)		<i>Dermatitis digitalis</i> and <i>interdigitalis</i> (%)		Claw horn lesions/ disruptions (%)		Ulcer (%)		Overall claw disorders (%)		Number of lactations (No.)
	90 ¹	305 ¹	90 ¹	305 ¹	90 ¹	305 ¹	90 ¹	305 ¹	90 ¹	305 ¹	
1 st	17.5	31.6	12.3	25.2	5.5	13.8	3.30	8.40	24.7	44.8	8 437
2 nd	16.1	29.9	12.2	24.1	8.9	22.2	5.70	15.5	24.9	46.6	6 405
3 rd	17.0	32.1	13.0	25.0	13.3	32.4	9.20	24.5	29.1	55.1	4 290
4 th	18.6	34.4	12.6	24.1	19.1	44.9	14.5	36.1	35.4	65.7	2 314
5 th and higher	19.9	35.6	14.2	25.7	25.5	52.6	20.7	43.8	40.7	70.3	1 369

¹From calving to 90th or from calving to 305th day in milk

Table S2. Variances and heritabilities for analysed foot and claw disorders; for 90 days in milk or for 305 days in milk (estimate ± estimate standard error)

	Overall claw disorders	Claw horn lesions/ disruptions	Infectious diseases	Ulcer	<i>Dermatitis digitalis</i> and <i>interdigitalis</i>
For 305 days in milk					
Linear model					
Additive variances	0.017 ± 0.002 1	0.018 ± 0.001 9	0.017 ± 0.001 9	0.011 ± 0.001 4	0.014 ± 0.001 6
Variances of permanent environment	0.012 ± 0.002 2	0.012 ± 0.001 8	0.006 ± 0.002 0	0.011 ± 0.001 4	0.007 ± 0.001 7
Residual variances	0.179 ± 0.002 2	0.133 ± 0.001 6	0.176 ± 0.002 1	0.110 ± 0.001 3	0.149 ± 0.001 8
Heritability	0.08	0.11	0.09	0.08	0.08
Threshold model					
Additive variances	0.186 ± 0.025 6	0.335 ± 0.040 9	0.189 ± 0.023 0	0.328 ± 0.055 2	0.136 ± 0.027 0
Variances of permanent environment	0.131 ± 0.025 6	0.266 ± 0.040 1	0.064 ± 0.021 4	0.329 ± 0.053 5	0.063 ± 0.029 1
Residual variances	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0
Heritability	0.14	0.21	0.15	0.20	0.11
For 90 days in milk					
Linear model					
Additive variances	0.011 ± 0.001 6	0.005 ± 0.000 7	0.007 ± 0.001 1	0.003 ± 0.000 5	0.004 ± 0.000 8
Variances of permanent environment	0.005 ± 0.001 8	0.002 ± 0.000 8	0.003 ± 0.001 3	0.002 ± 0.000 6	0.003 ± 0.001 0
Residual variances	0.172 ± 0.002 1	0.081 ± 0.001 0	0.127 ± 0.001 5	0.060 ± 0.000 7	0.099 ± 0.001 2
Heritability	0.06	0.05	0.05	0.04	0.04
Threshold model					
Additive variances	0.128 ± 0.020 2	0.204 ± 0.035 2	0.143 ± 0.023 7	0.229 ± 0.057 1	0.206 ± 0.032 0
Variances of permanent environment	0.067 ± 0.020 6	0.107 ± 0.036 2	0.052 ± 0.024 8	0.125 ± 0.053 0	0.045 ± 0.029 1
Residual variances	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0	1.000 ± 0.000 0
Heritability	0.11	0.16	0.12	0.17	0.16

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Table S3. Genetic correlations (above diagonal) and permanent environment correlations (below diagonal) between foot and claw disorders for 305 days in milk by the linear model (estimate $\pm$ estimate standard error)

	Overall claw disorders	Claw horn lesions/ disruptions	Infectious diseases	Ulcer	<i>Dermatitis digitalis</i> and <i>interdigitalis</i>
For 305 days in milk					
Overall claw disorders	–	0.76 $\pm$ 0.041**	0.70 $\pm$ 0.045**	0.70 $\pm$ 0.054**	0.59 $\pm$ 0.057**
Claw horn lesions/ disruptions	0.74 $\pm$ 0.076**	–	0.31 $\pm$ 0.075**	0.89 $\pm$ 0.020**	0.21 $\pm$ 0.077**
Infectious diseases	0.93 $\pm$ 0.087**	0.21 $\pm$ 0.157	–	0.30 $\pm$ 0.082**	0.95 $\pm$ 0.014**
Ulcer	0.74 $\pm$ 0.080**	0.94 $\pm$ 0.026**	0.33 $\pm$ 0.149*	–	0.21 $\pm$ 0.084*
<i>Dermatitis digitalis</i> and <i>interdigitalis</i>	0.62 $\pm$ 0.099**	-0.01 $\pm$ 0.137	0.92 $\pm$ 0.046**	0.16 $\pm$ 0.127	–
For 90 days in milk					
Overall claw disorders	–	0.69 $\pm$ 0.062**	0.89 $\pm$ 0.021**	0.72 $\pm$ 0.0716**	0.81 $\pm$ 0.052**
Claw horn lesions/ disruptions	0.62 $\pm$ 0.183**	–	0.44 $\pm$ 0.094**	0.93 $\pm$ 0.0161**	0.73 $\pm$ 0.133**
Infectious diseases	non-estimable	0.47 $\pm$ 0.291	–	0.53 $\pm$ 0.1047**	0.95 $\pm$ 0.020**
Ulcer	0.64 $\pm$ 0.188**	non-estimable	0.25 $\pm$ 0.268		0.53 $\pm$ 0.112**
<i>Dermatitis digitalis</i> and <i>interdigitalis</i>	0.62 $\pm$ 0.100**	0.40 $\pm$ 0.267	0.79 $\pm$ 0.096**	0.20 $\pm$ 0.250	–

*The estimate was significantly different from zero, $P < 0.05$; **The estimate was significantly different from zero, $P < 0.01$

Table S4. Correlations between foot and claw disorders and mastitis (305 days in milk) by the linear model (estimate $\pm$ estimate standard error)

Correlations	Overall claw disorders	Claw horn lesions/ disruptions	Infectious diseases	Ulcer	<i>Dermatitis digitalis</i> and <i>interdigitalis</i>
For 305 days in milk					
Genetic	0.14 $\pm$ 0.093	0.19 $\pm$ 0.084*	0.06 $\pm$ 0.091	0.12 $\pm$ 0.092	0.06 $\pm$ 0.091
Permanent environmental	0.10 $\pm$ 0.121	-0.02 $\pm$ 0.113	-0.01 $\pm$ 0.165	-0.04 $\pm$ 0.104	-0.19 $\pm$ 0.148
For 90 days in milk					
Genetic	0.20 $\pm$ 0.101*	0.23 $\pm$ 0.099*	0.22 $\pm$ 0.119	0.08 $\pm$ 0.112	0.05 $\pm$ 0.111
Permanent environmental	-0.14 $\pm$ 0.170	-0.11 $\pm$ 0.194	-0.04 $\pm$ 0.220	-0.17 $\pm$ 0.177	-0.24 $\pm$ 0.180

*The estimate was significantly different from zero, $P < 0.05$

<https://doi.org/10.17221/140/2025-CJAS>Table S5. Genetic correlations and correlations by permanent environment between foot and claw disorders and reproductive traits by the linear model (estimate $\pm$ estimate standard error)

	Overall claw disorders	Claw horn lesions/ disruptions	Infectious diseases	Ulcer	<i>Dermatitis digitalis</i> and <i>interdigitalis</i>
For 305 days in milk					
Calving interval					
Genetic	0.03 $\pm$ 0.105	0.10 $\pm$ 0.097	−0.10 $\pm$ 0.101	0.11 $\pm$ 0.101	−0.14 $\pm$ 0.101
Permanent environmental	−0.08 $\pm$ 0.167	−0.08 $\pm$ 0.154	0.02 $\pm$ 0.229	−0.08 $\pm$ 0.169	0.12 $\pm$ 0.203
Days open					
Genetic	−0.11 $\pm$ 0.101	−0.01 $\pm$ 0.095	−0.22 $\pm$ 0.091**	0.17 $\pm$ 0.100	−0.27 $\pm$ 0.096**
Permanent environmental	−0.01 $\pm$ 0.150	−0.06 $\pm$ 0.136	0.22 $\pm$ 0.213	−0.23 $\pm$ 0.125	0.36 $\pm$ 0.194*
The interval between calving and first service					
Genetic	0.00 $\pm$ 0.119	0.12 $\pm$ 0.109	−0.08 $\pm$ 0.115	0.18 $\pm$ 0.116	−0.02 $\pm$ 0.115
Permanent environmental	0.02 $\pm$ 0.155	−0.06 $\pm$ 0.143	0.15 $\pm$ 0.213	−0.08 $\pm$ 0.134	0.13 $\pm$ 0.186
For 90 days in milk					
Calving interval					
Genetic	−0.03 $\pm$ 0.115	−0.06 $\pm$ 0.116	−0.10 $\pm$ 0.116	0.24 $\pm$ 0.236	−0.10 $\pm$ 0.124
Permanent environmental	0.25 $\pm$ 0.235	0.12 $\pm$ 0.254	0.17 $\pm$ 0.260	−0.10 $\pm$ 0.102	0.10 $\pm$ 0.239
Days open					
Genetic	−0.15 $\pm$ 0.111	−0.11 $\pm$ 0.112	−0.22 $\pm$ 0.115	0.00 $\pm$ 0.123	−0.26 $\pm$ 0.119**
Permanent environmental	0.36 $\pm$ 0.225	0.27 $\pm$ 0.235	0.31 $\pm$ 0.322	0.15 $\pm$ 0.211	0.36 $\pm$ 0.227*
Interval between calving and first service					
Genetic	0.15 $\pm$ 0.127	0.14 $\pm$ 0.128	0.04 $\pm$ 0.130	0.19 $\pm$ 0.139	0.10 $\pm$ 0.138
Permanent environmental	0.07 $\pm$ 0.214	−0.09 $\pm$ 0.240	0.24 $\pm$ 0.235	−0.09 $\pm$ 0.221	0.14 $\pm$ 0.222

*The estimate was significantly different from zero, $P < 0.05$; **The estimate was significantly different from zero, $P < 0.01$