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Relationships among clinical mastitis test-day records, somatic cell counts, and linear udder conformation traits in Czech dairy cows

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Table S1. Phenotypic correlations between somatic cell score in different lactation periods and logarithmic mean of somatic cell counts for the whole lactation (LSCS)

Days in milk	*n*	Mean ±SD	Range	Phenotypic correlations with LSCS
0–30	9 359	2.86 ± 1.63	0.06–9.58	0.48
30–60	10 903	2.67 ± 1.64	0.06–9.53	0.61
60–90	11 109	2.75 ± 1.62	0.06–9.94	0.66
90–120	9 334	2.83 ± 1.58	0.06–9.52	0.65
120–150	11 191	2.91 ± 1.59	0.06–10.29	0.68
150–180	11 205	2.98 ± 1.57	0.06–10.53	0.69
180–210	11 102	3.03 ± 1.56	0.06–9.37	0.69
210–240	11 090	3.07 ± 1.52	0.06–9.57	0.66
240–270	10 877	3.17 ± 1.50	0.06–9.96	0.66
270–300	9 536	3.31 ± 1.49	0.06–9.64	0.57
LSCS	12 384	3.38 ± 1.35	0.06–8.70	–

All correlations are significant at $P < 0.01$

LSCS = logarithmic mean of somatic cell counts for the whole lactation

Table S2. Phenotypic correlations among the somatic cell scores in different lactation periods by 30 days in milk

Days in milk	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300
0–30	0.45	0.35	0.29	0.27	0.25	0.24	0.22	0.20	0.18
30–60	–	0.49	0.43	0.38	0.35	0.32	0.30	0.28	0.24
60–90	–	–	0.53	0.49	0.44	0.42	0.37	0.36	0.31
90–120	–	–	–	0.59	0.53	0.49	0.44	0.42	0.37
120–150	–	–	–	–	0.56	0.52	0.48	0.44	0.39
150–180	–	–	–	–	–	0.58	0.55	0.49	0.45
180–210	–	–	–	–	–	–	0.58	0.54	0.48
210–240	–	–	–	–	–	–	–	0.58	0.52
240–270	–	–	–	–	–	–	–	–	0.56

All correlations are significant at $P < 0.01$

Table S3. Phenotypic correlations between clinical mastitis and somatic cell scores for different lactation periods

		Clinical mastitis incidence in lactation periods 50 days long and for the whole lactation							
Days in milk		to 50	51–100	101–150	151–200	201–250	251–300	301–350	0–500
Somatic cell scores in lactation periods 30 days long	0–30	0.24	0.08	0.06	0.06	0.04	0.01^{ns}	0.02^{ns}	0.18
	30–60	0.17	0.17	0.08	0.08	0.04	0.04	0.03^{ns}	0.19
	60–90	0.10	0.23	0.13	0.09	0.06	0.07	0.04*	0.19
	90–120	0.06	0.16	0.18	0.10	0.08	0.07	0.06	0.18
	120–150	0.06	0.13	0.22	0.12	0.09	0.06	0.09	0.19
	150–180	0.04	0.10	0.15	0.17	0.11	0.09	0.08	0.17
	180–210	0.05	0.10	0.13	0.22	0.15	0.09	0.07	0.20
	210–240	0.04	0.09	0.11	0.14	0.20	0.11	0.10	0.18
	240–270	0.03	0.08	0.11	0.13	0.16	0.16	0.09	0.17
	270–300	0.02*	0.07	0.09	0.10	0.14	0.17	0.12	0.16
	LSCS	0.11	0.20	0.20	0.20	0.15	0.13	0.09	0.29

All correlations are significant at $P < 0.01$; except $^{*}P < 0.05$;

LSCS = logarithmic mean of somatic cell counts for the whole lactation; ns = nonsignificant

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Table S4. Phenotypic correlations among conformation traits

	FTP	TL	UD	RUH	CL	RTP	UW	BCS
FUA	0.12	0.07	0.38	0.30	0.16	0.09	0.15	0.18
FTP	–	–0.13	0.19	0.03	0.09	0.45	0.05	–0.05
TL	–	–	–0.06	0.06	0.10	–0.10	0.11	0.12
UD	–	–	–	0.22	0.23	0.16	–0.07	–0.09
RUH	–	–	–	–	0.28	0.06	0.44	–0.07
CL	–	–	–	–	–	0.18	0.19	–0.04
RTP	–	–	–	–	–	–	0.05	–0.07*
UW	–	–	–	–	–	–	–	–0.02

All correlations are significant at $P < 0.01$; except $^*P < 0.05$

BCS = body condition score; CL = central ligament; FTP = front teat placement; FUA = fore udder attachment; RTP = rear teat placement; RUH = rear udder height; TL = teat length; UD = udder depth; UW = udder width

Table S5. Phenotypic correlations among conformation traits and the clinical mastitis (CM) incidence in different lactation periods by 50 days in milk

CM	FUA	FTP	TL	UD	RUH	CL	RTP	UW	BCS
to 50	–0.04	–0.05	0.00^{ns}	–0.05	–0.04	–0.10	–0.03	–0.04	0.01^{ns}
51–100	–0.05	–0.04	0.00^{ns}	-0.01^{ns}	–0.02*	–0.04	–0.02*	0.01^{ns}	–0.02*
101–150	–0.03	–0.02*	–0.01*	–0.01*	0.00^{ns}	–0.02*	–0.03*	0.02*	-0.02^{ns}
151–200	–0.02*	–0.02*	0.00^{ns}	0.00^{ns}	0.01^{ns}	-0.01^{ns}	–0.03	0.01^{ns}	–0.03*
201–250	–0.03	–0.02*	0.00^{ns}	-0.01^{ns}	0.01^{ns}	0.00^{ns}	0.00^{ns}	0.04	–0.02*
251–300	–0.02*	–0.02*	-0.01^{ns}	-0.01^{ns}	0.00^{ns}	0.01^{ns}	-0.01^{ns}	0.02^{ns}	-0.02^{ns}
301–350	–0.05	-0.01^{ns}	0.00^{ns}	0.00^{ns}	-0.01^{ns}	-0.01^{ns}	0.01^{ns}	-0.02^{ns}	0.01^{ns}
0–500	–0.07	–0.06	-0.01^{ns}	–0.03	–0.02*	–0.05	–0.04	0.01^{ns}	–0.02*

All correlations are significant at $P < 0.01$; except $^*P < 0.05$

BCS = body condition score; CL = central ligament; FTP = front teat placement; FUA = fore udder attachment; ns = non-significant; RTP = rear teat placement; RUH = rear udder height; TL = teat length; UD = udder depth; UW = udder width

Table S6. The least square means for clinic mastitis (CM) considering conformation traits

Traits	2	3	4	5	6	7	8	9	SE
FUA	0.38	0.29	0.26	0.23	0.22	0.19	0.21	–	0.01–0.02
FTP	0.34	0.26	0.23	0.23	0.23	0.25	0.26	–	0.01–0.03
TL	0.31	0.26	0.25	0.22	0.24	0.23	0.28	–	0.01–0.03
UD	0.44	0.32	0.28	0.24	0.23	0.20	0.18	–	0.01–0.21
RUH	0.37	0.30	0.26	0.24	0.23	0.23	0.22	0.24	0.01–0.03
CL	0.37	0.31	0.27	0.24	0.22	0.21	0.19	0.15	0.01–0.02
RTP	–	0.36	0.32	0.28	0.28	0.27	0.29	0.31	0.01–0.03
UW	–	0.32	0.28	0.29	0.28	0.29	0.28	0.34	0.01–0.03
BCS	–	0.32	0.29	0.28	0.27	0.27	0.27	–	0.01–0.03

All values are significant at $P < 0.01$

BCS = body condition score; CL = central ligament; FTP = front teat placement; FUA = fore udder attachment; RTP = rear teat placement; RUH = rear udder height; SE = standard error; TL = teat length; UD = udder depth; UW = udder width

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Table S7. The least squared means of clinical mastitis and fore udder attachment score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.20	0.08	0.05	0.04	0.06	0.06	0.07	0.01–0.02
3	0.12	0.05	0.05	0.05	0.04	0.06	0.06	0.01
4	0.11	0.05	0.04	0.05	0.04	0.04	0.04	0.00–0.01
5	0.10	0.04	0.04	0.04	0.04	0.04	0.05	0.00–0.01
6	0.09	0.04	0.04	0.04	0.04	0.04	0.04	0.00–0.01
7	0.08	0.03	0.03	0.03	0.03	0.03	0.04	0.00–0.01
8	0.08	0.03	0.04	0.04	0.04	0.03	0.06	0.01–0.02

All values are significant at $P < 0.01$

Score 2: weak and loose fore udder attachment with bulging fore quarters (combined score one and two); score 3: weak fore udder attachment; score 4: intermediate acceptable fore udder attachment; the attachment to the abdominal wall is not smooth; score 5: intermediate proper fore udder attachment; score 6: intermediate adequate fore udder attachment; score 7: strong and tight fore udder attachment tightly adjacent to the abdominal wall and score 8: extremely strong and tight; significantly flat attachment to the abdominal wall (combined score eight and nine)

SE = standard error

Table S8. The least squared means of clinical mastitis and front teat placement score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.17	0.08	0.07	0.06	0.04	0.06	0.05	0.01–0.02
3	0.11	0.04	0.05	0.04	0.04	0.04	0.04	0.01
4	0.09	0.04	0.04	0.05	0.04	0.04	0.05	0.00–0.01
5	0.09	0.04	0.04	0.04	0.04	0.04	0.05	0.00–0.01
6	0.10	0.04	0.04	0.04	0.04	0.04	0.04	0.00–0.01
7	0.10	0.06	0.04	0.05	0.03	0.03	0.05	0.01
8	0.12	0.06	0.04	0.06	0.03	0.04	0.04^{ns}	0.01–0.03

All values are significant at $P < 0.01$; except nonsignificant

Score 2: front teats outside of the quarter on the lateral side (combined score one and two); score 3: front teats outside of the quarter; score 4: front teats middle of the quarter; score 5: front teats middle of the quarter; score 6: front teats middle of the quarter; score 7: front teats inside of the quarter closer to medial furrow (central ligament) and score 8: front teats inside of the quarter very close to medial furrow (combined score eight and nine)

ns = nonsignificant; SE = standard error

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Table S9. The least squared means of clinical mastitis and teat length score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.14	0.08	0.06	0.07	0.04	0.07	0.04^{ns}	0.02–0.03
3	0.13	0.04	0.04	0.04	0.04	0.04	0.06	0.01
4	0.10	0.04	0.04	0.04	0.04	0.04	0.05	0.00–0.01
5	0.09	0.04	0.04	0.04	0.04	0.03	0.04	0.00–0.01
6	0.10	0.04	0.04	0.05	0.04	0.05	0.05	0.00–0.01
7	0.10	0.04	0.03	0.04	0.06	0.04	0.05	0.01–0.02
8	0.11	0.05	0.02^{ns}	0.05	0.05	0.04*	0.06	0.01–0.03

All values are significant at $P < 0.01$; except $^{*}P < 0.05$

Score 2: very short front teats (combined score one and two); score 3: short front teats; score 4: short front teats; score 5: intermediate front teats; score 6: intermediate front teats; score 7: longer front teats and score 8: very long front teats (combined score eight and nine)

ns = nonsignificant; SE = standard error

Table S10. The least squared means of clinical mastitis and udder depth score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.21	0.11	0.08	0.06	0.07	0.07	0.12	0.01–0.02
3	0.14	0.07	0.04	0.06	0.06	0.05	0.08	0.01
4	0.12	0.05	0.05	0.05	0.04	0.04	0.05	0.01
5	0.10	0.04	0.04	0.04	0.04	0.04	0.04	0.00–0.01
6	0.09	0.04	0.04	0.04	0.04	0.04	0.04	0.00–0.01
7	0.08	0.03	0.03	0.03	0.02	0.03	0.05	0.00–0.01
8	0.06	0.03	0.03	0.04	0.03	0.04	0.04	0.01

All values are significant at $P < 0.01$

Score 2: the lowest part of the udder bellows the hock (combined score one and two); score 3: bottom line 3 cm under the hock; score 4: bottom line 6 cm under the hock; score 5: bottom line 9 cm under the hock; score 6: bottom line 11.5 cm under the hock; score 7: bottom line 15 cm under the hock a score 8: bottom line 21 cm under the hock-shallow udder (combined score eight and nine)

SE = standard error

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Table S11. The least squared means of clinical mastitis and rear udder height score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.19	0.10	0.06	0.04	0.04	0.07	0.04^{ns}	0.01–0.02
3	0.17	0.05	0.04	0.04	0.04	0.04	0.05	0.01–0.02
4	0.12	0.05	0.03	0.04	0.04	0.04	0.04	0.00–0.01
5	0.10	0.04	0.04	0.05	0.03	0.04	0.05	0.00–0.01
6	0.09	0.04	0.04	0.04	0.04	0.04	0.04	0.00–0.01
7	0.09	0.04	0.04	0.05	0.04	0.05	0.04	0.00–0.01
8	0.07	0.04	0.04	0.04	0.05	0.03	0.04	0.01
9	0.08	0.04	0.05	0.05	0.05	0.04	0.03^{ns}	0.01–0.02

All values are significant at $P < 0.01$; except nonsignificant

Score 2: very low rear udder height (combined score one and two); score 3: very low rear udder height; score 4: intermediate rear udder height (udder attachment in reference point); score 5: Intermediate rear udder height; score 6: Intermediate rear udder height; score 7: higher rear udder height; score 8: high rear udder height and score 9: very high rear udder height

ns = nonsignificant; SE = standard error

Table S12. The least squared means of clinical mastitis and central ligament score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.20	0.09	0.07	0.07	0.05	0.04	0.06	0.01
3	0.16	0.06	0.05	0.05	0.04	0.05	0.07	0.01
4	0.14	0.05	0.04	0.05	0.03	0.04	0.04	0.00–0.01
5	0.11	0.04	0.04	0.04	0.04	0.03	0.05	0.00–0.01
6	0.08	0.03	0.04	0.04	0.03	0.04	0.05	0.00–0.01
7	0.07	0.03	0.04	0.04	0.04	0.04	0.05	0.00–0.01
8	0.05	0.04	0.03	0.04	0.04	0.04	0.03	0.01
9	0.04*	0.03*	0.03	0.04	0.02^{ns}	0.04	0.01^{ns}	0.01–0.02

All values are significant at $P < 0.01$; except $^{*}P < 0.05$

Score 2: convex to the flat floor from +1 cm to +0.5 cm (combined score one and two); score 3: convex to the flat bottom +0 cm; score 4: slight definition –1 cm; score 5: slight definition –2 cm; score 6: slight definition –3 cm; score 7: deep definition –4 cm; score 8: deep definition –5 cm; score 9: deep definition –6 cm

ns = nonsignificant; SE = standard error

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Table S13. The least squared means of clinical mastitis and rear teat placement score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.17	0.07	0.07	0.06	0.04	0.06	0.05	0.01–0.02
3	0.14	0.06	0.06	0.06	0.05	0.04	0.05	0.01
4	0.12	0.05	0.05	0.05	0.04	0.05	0.05	0.00–0.01
5	0.12	0.05	0.05	0.05	0.04	0.05	0.06	0.00–0.01
6	0.12	0.04	0.04	0.05	0.05	0.04	0.05	0.00–0.01
7	0.12	0.05	0.05	0.04	0.05	0.05	0.04	0.01
8	0.18	0.03*	0.04*	0.02^{ns}	0.03^{ns}	0.06	0.04^{ns}	0.02–0.03

All values are significant at $P < 0.01$; except $^*P < 0.05$

Score 2: rear teats outside of the quarter (combined score one and two); score 4: rear teats middle of the quarter; score 5: rear teats middle of the quarter; score 6: rear teats middle of the quarter; score 7: rear teats inside of the quarter (touching teats); score 8: rear teats inside of the quarter (crossing teats) (combined score eight and nine)

ns = nonsignificant; SE = standard error

Table S14. The least squared means of clinical mastitis and udder width score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
3	0.16	0.06	0.06	0.05	0.05	0.04	0.07	0.01–0.02
4	0.14	0.05	0.04	0.05	0.03	0.04	0.05	0.01
5	0.14	0.05	0.04	0.05	0.04	0.05	0.05	0.00–0.01
6	0.12	0.05	0.05	0.05	0.04	0.04	0.05	0.00–0.01
7	0.11	0.05	0.05	0.05	0.06	0.05	0.05	0.00–0.01
8	0.09	0.05	0.05	0.05	0.06	0.05	0.05	0.01
9	0.12	0.07	0.06	0.06	0.07	0.06	0.05*	0.01–0.02

All values are significant at $P < 0.01$; except $^*P < 0.05$

Score 3: udder width 6–8 cm (combined score one, two, and three); score 4: udder width 8–9 cm; score 5: udder width 9–9.5 cm; score 6: udder width 10 cm; score 7: udder width 10.5 cm; score 8: udder width 11 cm and score 9: udder width 12 cm (combined score eight and nine)

SE = standard error

Table S15. The least squared means of clinical mastitis and body condition score in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
3	0.13	0.05	0.07	0.06	0.07	0.05	0.06	0.01–0.02
4	0.11	0.05	0.05	0.06	0.04	0.05	0.05	0.00–0.01
5	0.11	0.05	0.04	0.05	0.05	0.05	0.05	0.00–0.01
6	0.13	0.04	0.04	0.05	0.04	0.04	0.05	0.00–0.01
7	0.15	0.05	0.04	0.03	0.03	0.04	0.05	0.01–0.02
8	0.16	0.04	0.04*	0.05	0.05	0.03^{ns}	0.06^{ns}	0.02–0.03

All values are significant at $P < 0.01$, except $^*P < 0.05$

Score 3: body condition score 1–2 (combined score one, two, and three); score 4: body condition score 2–2.5; score 5: body condition score 2.5–3; score 6: body condition score 3–3.5; score 7: body condition score 3.5–4 and score 8: body condition score 5 (combined score eight and nine)

ns = nonsignificant; SE = standard error

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Table S16. Odds ratios for clinical mastitis in the first lactation and conformations traits

Traits	2	3	4	5	6	7	8•	9•	SE
FUA	1.46	1.16	1.07	1.01	0.99	0.86	1.00	–	0.13–0.17
FTP	1.02	0.89	0.84	0.90	0.88	0.90	1.00	–	0.18–0.21
TL	0.92	0.89	0.85	0.78	0.88	0.78	1.00	–	0.18–0.26
UD	2.56*	1.73*	1.65*	1.40	1.34	1.17	1.00	–	0.09–0.17
RUH	0.91	0.90	0.80	0.85	0.83	0.90	0.87	1.00	0.13–0.22
CL	2.61	2.52	2.10	1.81	1.56	1.59	1.34	1.00	0.17–0.20
RTP	–	1.37	1.12	0.92	0.93	0.86	0.94	1.00	0.19–0.21
UW	–	0.97	0.80	0.84	0.79	0.81	0.76	1.00	0.15–0.18
BCS	–	0.82	0.66	0.67	0.80	1.03	1.00	–	0.25–0.28

All values are nonsignificant; except $^*P < 0.05$; •Conformation scores eighth and ninth equal one and is a baseline
BCS = body condition score; CL = central ligament; FTP = front teat placement; FUA = fore udder attachment; RTP = rear teat placement; RUH = rear udder height; SE = standard error; TL = teat length; UD = udder depth; UW = udder width

Table S17. Odds ratios estimated by logistic animal model for fore udder attachment score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	1.45	1.42	1.03	0.91	1.28	1.38	0.90	0.20–0.55
3	1.03	1.20	1.07	1.33	0.99	1.67	0.87	0.17–0.42
4	1.08	1.23	1.00	1.21	1.03	1.19	0.56	0.16–0.40
5	0.99	1.10	1.01	1.12	0.86	1.06	0.66	0.16–0.38
6	0.99	1.13	1.00	1.12	0.88	1.16	0.61	0.15–0.38
7	0.95	0.97	0.90	0.81	0.74	1.07	0.67	0.16–0.39
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 8^{th} score
Score 2: weak and loose fore udder attachment with bulging fore quarters (combined score one and two); score 3: weak fore udder attachment; score 4: intermediate acceptable fore udder attachment; the attachment to the abdominal wall is not smooth; score 5: intermediate proper fore udder attachment; score 6: intermediate adequate fore udder attachment; score 7: strong and tight fore udder attachment tightly adjacent to the abdominal wall and score 8: extremely strong and tight; significantly flat attachment to the abdominal wall (combined score eight and nine)
SE = standard error of the clinical mastitis odds ratio

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Table S18. Odds ratios estimated by logistic animal model for front teat placement score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.93	0.87	1.26	0.67	0.88	1.07	0.75	0.26–0.76
3	0.83	0.67	1.09	0.47	1.15	0.92	0.77	0.23–0.71
4	0.75	0.76	0.97	0.64	1.26	0.91	1.10	0.22–0.68
5	0.81	0.70	1.03	0.62	1.24	0.86	1.19	0.22–0.67
6	0.83	0.78	0.98	0.53	1.34	0.81	1.06	0.22–0.68
7	0.83	0.91	0.97	0.69	1.11	0.65	1.13	0.24–0.72
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 8th score

Score 2: front teats outside of the quarter on the lateral side (combined score one and two); score 3: front teats outside of the quarter; score 4: front teats middle of the quarter; score 5: front teats middle of the quarter; score 6: front teats middle of the quarter; score 7: front teats inside of the quarter closer to medial furrow (central ligament) and score 8: front teats inside of the quarter very close to medial furrow (combined score eight and nine)

SE = standard error of the clinical mastitis odds ratio

Table S19. Odds ratios estimated by logistic animal model for teat length score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	1.07	1.17	1.36	1.33	0.77	1.91	0.45	0.34–0.87
3	1.10	0.78	1.27	0.69	0.87	1.30	0.89	0.25–0.60
4	0.95	0.96	1.21	0.79	0.77	1.42	0.81	0.24–0.57
5	0.90	0.93	1.25	0.83	0.74	1.01	0.67	0.24–0.57
6	0.95	0.95	1.25	1.00	0.79	1.53	0.84	0.25–0.58
7	0.99	0.94	1.15	0.62	1.27	1.22	0.88	0.27–0.64
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 8th score

Score 2: very short front teats (combined score one and two); score 3: short front teats; score 4: short front teats; score 5: intermediate front teats; score 6: intermediate front teats; score 7: longer front teats and score 8: very long front teats (combined score eight and nine)

SE = standard error of the clinical mastitis odds ratio

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Table S20. Odds ratios estimated by logistic animal model for udder depth score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	1.72	1.71	1.33	1.47	2.67	1.54	4.27	0.20–0.46
3	1.47	1.26	1.04	1.41	2.05	1.16	2.13	0.16–0.39
4	1.50	1.16	1.13	1.20	1.45	1.05	1.50	0.12–0.33
5	1.43	1.05	1.07	1.18	1.28	1.09	0.98	0.11–0.31
6	1.36	1.04	1.05	1.18	1.32	0.95	1.13	0.11–0.30
7	1.30	1.02	1.04	0.94	0.83	0.84	1.18	0.11–0.30
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 8th score

Score 2: the lowest part of the udder bellows the hock (combined score one and two); score 3: bottom line 3 cm under the hock; score 4: bottom line 6 cm under the hock; score 5: bottom line 9 cm under the hock; score 6: bottom line 11.5 cm under the hock; score 7: bottom line 15 cm under the hock a score 8: bottom line 21 cm under the hock-shallow udder (combined score eight and nine)

SE = standard error of the clinical mastitis odds ratio

Table S21. Odds ratios estimated by logistic animal model for rear udder height score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	1.24	1.22	0.90	0.45	0.37	1.38	0.53	0.27–0.73
3	1.33	0.93	0.80	0.48	0.49	0.92	1.10	0.21–0.53
4	1.05	0.98	0.79	0.54	0.60	0.98	0.93	0.19–0.45
5	0.98	1.00	0.91	0.75	0.56	0.93	1.31	0.18–0.42
6	0.97	0.94	0.87	0.69	0.68	1.00	1.14	0.18–0.41
7	0.94	1.00	0.85	0.84	0.64	1.25	1.14	0.18–0.42
8	0.80	1.07	0.89	0.81	0.97	0.90	1.25	0.19–0.45
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 9th score

Score 2: very low rear udder height (combined score one and two); score 3: very low rear udder height; score 4: intermediate rear udder height (udder attachment in reference point); score 5: Intermediate rear udder height; score 6: Intermediate rear udder height; score 7: higher rear udder height; score 8: high rear udder height and score 9: very high rear udder height

SE = standard error of the clinical mastitis odds ratio

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Table S22. Odds ratios estimated by logistic animal model for central ligament score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	3.79*	1.53	1.20	2.51	3.01	0.76	1.88	0.26–0.65
3	3.37*	1.28	1.10	1.71	2.25	1.15	3.21	0.25–0.59
4	2.83*	1.32	1.08	1.27	2.06	1.01	1.67	0.24–0.58
5	2.27	1.19	1.07	1.09	2.67	0.89	2.28	0.23–0.56
6	1.69	1.06	1.05	1.05	1.91	1.22	2.62	0.23–0.56
7	1.56	1.03	1.06	1.14	2.53	1.12	2.55	0.23–0.56
8	1.25	1.08	0.95	0.94	2.64	1.10	1.54	0.24–0.59
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; except $^{*}P < 0.05$; Estimations were related to reference 9th score

Score 2: convex to the flat floor from +1 cm to +0.5 cm (combined score one and two); score 3: convex to the flat bottom +0 cm; score 4: slight definition –1 cm; score 5: slight definition –2 cm; score 6: slight definition –3 cm; score 7: deep definition –4 cm; score 8: deep definition –5 cm; score 9: deep definition –6 cm

SE = standard error of the clinical mastitis odds ratio

Table S23. Odds ratios estimated by logistic animal model for rear teat placement and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
2	0.91	1.74	1.58	1.61	1.05	1.16	1.08	0.27–0.46
3	0.70	1.42	1.34	1.60	1.29	0.82	1.05	0.25–0.43
4	0.60	1.26	1.16	1.49	1.13	0.89	1.03	0.24–0.41
5	0.57	1.28	1.16	1.44	1.09	0.92	1.10	0.24–0.41
6	0.57	1.11	1.05	1.36	1.18	0.85	1.05	0.24–0.41
7	0.58	1.27	1.23	1.20	1.21	0.88	1.00	0.26–0.42
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

Values were nonsignificant; Estimations were related to reference 8th score

Score 2: rear teats outside of the quarter (combined score one and two), score 4: rear teats middle of the quarter, score 5: rear teats middle of the quarter, score 6: rear teats middle of the quarter, score 7: rear teats inside of the quarter (touching teats), score 8: rear teats inside of the quarter (crossing teats) (combined score eight, and nine)

SE = standard error of the clinical mastitis odds ratio

Table S24. Odds ratios estimated by logistic animal model for udder width and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
3	1.47	0.84	1.07	0.82	0.75	0.69	1.16	0.26–0.40
4	1.27	0.65	0.79	0.80	0.53	0.69	0.99	0.23–0.34
5	1.25	0.67	0.80	0.75	0.66	0.83	1.00	0.22–0.32
6	0.95	0.70	0.89	0.77	0.65	0.70	1.01	0.22–0.32
7	0.84	0.65	0.98	0.78	0.84	0.87	0.98	0.22–0.32
8	0.68	0.64	0.96	0.82	0.94	0.90	0.99	0.23–0.34
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 9th score

Score 3: udder width 6–8 cm (combined score one, two, and three); score 4: udder width 8–9 cm; score 5: udder width 9–9.5 cm; score 6: udder width 10 cm; score 7: udder width 10.5 cm; score 8: udder width 11 cm and score 9: udder width 12 cm (combined score eight and nine)

SE = standard error of the clinical mastitis odds ratio

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Table S25. Odds ratios estimated by logistic animal model for body condition score and clinical mastitis incidence in different lactation periods by 50 days in milk

Score	to 50	51–100	101–150	151–200	201–250	251–300	301–350	SE
3	0.82	1.21	1.51	1.04	1.20	1.16	0.96	0.28–0.53
4	0.66	1.19	1.13	1.04	0.83	1.27	0.92	0.26–0.49
5	0.67	1.12	1.10	0.89	0.92	1.20	0.92	0.25–0.49
6	0.80	1.00	1.03	0.88	0.85	1.02	0.92	0.25–0.49
7	1.03	1.02	1.09	0.62	0.67	0.95	0.97	0.27–0.53
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

All values are nonsignificant; Estimations were related to reference 8th score

Score 3: body condition score 1–2 (combined score one, two, and three); score 4: body condition score 2–2.5; score 5: body condition score 2.5–3; score 6: body condition score 3–3.5; score 7: body condition score 3.5–4 and score 8: body condition score 5 (combined score eight and nine)

SE = standard error of the clinical mastitis odds ratio

Table S26. The least square means for somatic cell score considering conformation traits

Traits	2	3	4	5	6	7	8	9	SE
FUA	3.76	3.54	3.44	3.37	3.35	3.27	3.33	–	0.03–0.07
FTP	3.70	3.47	3.41	3.36	3.33	3.48	3.49	–	0.02–0.11
TL	3.57	3.49	3.43	3.34	3.35	3.35	3.45	–	0.02–0.13
UD	4.10	3.69	3.57	3.43	3.32	3.28	3.20	–	0.03–0.09
RUH	3.82	3.44	3.46	3.38	3.36	3.35	3.37	3.43	0.03–0.10
CL	3.93	3.58	3.44	3.40	3.36	3.28	3.30	3.18	0.03–0.09
RTP	–	3.62	3.39	3.33	3.35	3.26	3.43	3.39	0.03–0.11
UW	–	3.44	3.35	3.30	3.29	3.36	3.38	3.63	0.03–0.09
BCS	–	3.45	3.31	3.29	3.28	3.35	3.57	–	0.02–0.12

All values are significant at $P < 0.01$

BCS = body condition score; CL = central ligament; FTP = front teat placement; FUA = fore udder attachment; RTP = rear teat placement; RUH = rear udder height; SE = standard error; TL = teat length; UD = udder depth; UW = udder width

Table S27. The least squared means of fore udder attachment and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.33	3.10	2.97	3.24	3.21	3.17	3.41	3.29	3.42	3.67	0.08–0.09
3	3.07	2.82	2.80	2.89	2.97	2.99	3.10	3.14	3.21	3.34	0.05–0.06
4	2.96	2.66	2.70	2.88	2.93	2.97	3.04	3.09	3.15	3.35	0.04
5	2.90	2.64	2.71	2.81	2.86	2.91	2.97	3.03	3.13	3.23	0.03–0.04
6	2.92	2.59	2.62	2.73	2.81	2.88	2.97	2.97	3.09	3.23	0.03–0.04
7	2.84	2.53	2.55	2.65	2.75	2.86	2.92	2.91	3.04	3.14	0.04–0.05
8	2.80	2.59	2.55	2.80	2.69	2.84	2.98	3.06	3.13	3.12	0.09–0.11

All values are significant at $P < 0.01$

Score 2: weak and loose fore udder attachment with bulging fore quarters (combined score one and two); score 3: weak fore udder attachment; score 4: intermediate acceptable fore udder attachment; the attachment to the abdominal wall is not smooth; score 5: intermediate proper fore udder attachment; score 6: intermediate adequate fore udder attachment; score 7: strong and tight fore udder attachment tightly adjacent to the abdominal wall and score 8: extremely strong and tight; significantly flat attachment to the abdominal wall (combined score eight and nine)

SE = standard error

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Table S28. The least squared means of front teat placement and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.40	3.08	2.97	3.19	3.20	3.22	3.26	3.32	3.38	3.49	0.09–0.11
3	2.97	2.72	2.73	2.94	2.88	2.90	3.06	3.04	3.13	3.31	0.06–0.07
4	2.93	2.66	2.72	2.81	2.86	2.93	3.05	3.06	3.13	3.26	0.03–0.04
5	2.94	2.60	2.61	2.76	2.85	2.91	2.95	3.01	3.13	3.24	0.03–0.04
6	2.89	2.59	2.66	2.75	2.82	2.88	2.97	2.99	3.09	3.23	0.03–0.04
7	2.81	2.78	2.74	2.86	2.87	2.91	3.04	2.98	3.12	3.29	0.06–0.07
8	3.17	2.85	2.77	3.08	3.28	3.16	3.26	3.18	3.33	3.55	0.12–0.16

All values are significant at $P < 0.01$

Score 2: front teats outside of the quarter on the lateral side (combined score one and two); score 3: front teats outside of the quarter; score 4: front teats middle of the quarter; score 5: front teats middle of the quarter; score 6: front teats middle of the quarter; score 7: front teats inside of the quarter closer to medial furrow (central ligament) and score 8: front teats inside of the quarter very close to medial furrow (combined score eight and nine)

SE = standard error

Table S29. The least squared means of teat length and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.39	3.17	2.98	3.08	3.09	3.36	3.29	3.24	3.18	3.47	0.14–0.19
3	3.08	2.74	2.76	2.92	2.92	2.92	2.98	3.08	3.25	3.34	0.05–0.06
4	2.96	2.68	2.70	2.84	2.86	2.92	3.03	3.04	3.12	3.32	0.03–0.04
5	2.88	2.60	2.64	2.75	2.84	2.91	2.98	3.01	3.10	3.20	0.03–0.04
6	2.91	2.57	2.64	2.72	2.86	2.88	2.95	3.01	3.17	3.23	0.04–0.05
7	2.98	2.68	2.65	2.82	2.93	2.85	3.04	2.99	3.10	3.11	0.08–0.10
8	2.77	2.62	2.72	2.74	2.96	2.97	3.00	2.96	3.02	3.32	0.13–0.15

All values are significant at $P < 0.01$

Score 2: very short front teats (combined score one and two); score 3: short front teats; score 4: short front teats; score 5: intermediate front teats; score 6: intermediate front teats; score 7: longer front teats and score 8: very long front teats (combined score eight and nine)

SE = standard error

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Table S30. The least squared means of udder depth and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.66	3.41	3.30	3.53	3.57	3.57	3.68	3.70	3.47	3.72	0.10–0.12
3	3.26	3.04	2.97	3.16	3.26	3.13	3.42	3.34	3.41	3.52	0.07–0.09
4	3.06	2.83	2.82	3.00	3.03	3.06	3.06	3.15	3.24	3.42	0.04–0.06
5	2.97	2.66	2.71	2.85	2.93	2.96	3.07	3.07	3.17	3.30	0.03–0.04
6	2.87	2.55	2.64	2.74	2.81	2.89	2.96	2.99	3.09	3.21	0.03–0.04
7	2.85	2.56	2.59	2.67	2.72	2.79	2.88	2.92	3.05	3.16	0.04
8	2.78	2.51	2.47	2.59	2.64	2.77	2.83	2.84	2.97	3.10	0.05–0.06

All values are significant at $P < 0.01$

Score 2: the lowest part of the udder bellows the hock (combined score one and two); score 3: bottom line 3 cm under the hock; score 4: bottom line 6 cm under the hock; score 5: bottom line 9 cm under the hock; score 6: bottom line 11.5 cm under the hock; score 7: bottom line 15 cm under the hock a score 8: bottom line 21 cm under the hock-shallow udder (combined score eight and nine)

SE = standard error

Table S31. The least squared means of rear udder height and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.39	3.28	3.19	3.54	3.27	3.43	3.42	3.42	3.40	3.52	0.13–0.15
3	3.14	2.88	2.80	2.89	2.97	3.00	3.03	3.09	3.18	3.31	0.08–0.09
4	3.02	2.72	2.73	2.88	2.92	2.98	3.05	3.02	3.11	3.25	0.04–0.05
5	2.92	2.64	2.63	2.79	2.84	2.89	2.98	3.01	3.08	3.25	0.03–0.04
6	2.95	2.64	2.73	2.79	2.82	2.89	2.99	3.04	3.15	3.30	0.03–0.04
7	2.83	2.58	2.63	2.73	2.86	2.91	3.01	3.03	3.13	3.23	0.04–0.05
8	2.88	2.57	2.61	2.76	2.88	2.94	3.00	3.01	3.19	3.23	0.05–0.07
9	2.84	2.40	2.42	2.75	2.90	2.86	2.93	2.97	3.15	3.28	0.09–0.11

All values are significant at $P < 0.01$

Score 2: very low rear udder height (combined score one and two); score 3: very low rear udder height; score 4: intermediate rear udder height (udder attachment in reference point); score 5: Intermediate rear udder height; score 6: Intermediate rear udder height; score 7: higher rear udder height; score 8: high rear udder height and score 9: very high rear udder height

SE = standard error

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Table S32. The least squared means of central ligament and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.75	3.37	3.30	3.40	3.37	3.38	3.53	3.42	3.50	3.54	0.08–0.10
3	3.22	2.91	2.86	2.95	2.91	2.91	3.08	3.07	3.14	3.37	0.06–0.07
4	3.03	2.77	2.72	2.87	2.86	2.93	3.00	3.03	3.08	3.22	0.04–0.05
5	2.87	2.68	2.66	2.79	2.88	2.92	2.99	3.02	3.13	3.27	0.03–0.04
6	2.90	2.53	2.64	2.77	2.83	2.91	2.98	3.03	3.11	3.23	0.03–0.04
7	2.85	2.50	2.60	2.72	2.78	2.86	2.92	2.99	3.13	3.25	0.04–0.05
8	2.76	2.51	2.59	2.66	2.86	2.88	3.00	2.99	3.10	3.21	0.06–0.07
9	2.52	2.33	2.39	2.39	2.79	2.74	2.86	2.78	3.03	3.34	0.13–0.15

All values are significant at $P < 0.01$

Score 2: convex to the flat floor from +1 cm to +0.5 cm (combined score one and two); score 3: convex to the flat bottom +0 cm; score 4: slight definition –1 cm; score 5: slight definition –2 cm; score 6: slight definition –3 cm; score 7: deep definition –4 cm; score 8: deep definition –5 cm; score 9: deep definition –6 cm

SE = standard error

Table S33. The least squared means of rear teat placement and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
2	3.17	2.82	2.94	3.12	2.94	3.12	3.13	3.22	3.33	3.35	0.08–0.09
3	2.89	2.69	2.65	2.74	2.86	2.92	3.02	3.02	3.06	3.25	0.05–0.06
4	2.87	2.65	2.64	2.68	2.75	2.83	2.93	2.90	3.06	3.18	0.04
5	2.96	2.66	2.72	2.77	2.82	2.89	2.98	3.01	3.14	3.21	0.03–0.04
6	2.84	2.60	2.62	2.75	2.76	2.81	2.90	2.95	3.04	3.18	0.03–0.04
7	2.99	2.64	2.72	2.80	2.94	2.99	2.94	2.99	3.15	3.22	0.05–0.06
8	2.69	2.52	2.53	2.56	2.83	2.60	2.79	2.70	2.75	2.91	0.15–0.17

All values are significant at $P < 0.01$

Score 2: rear teats outside of the quarter (combined score one and two); score 4: rear teats middle of the quarter; score 5: rear teats middle of the quarter; score 6: rear teats middle of the quarter; score 7: rear teats inside of the quarter (touching teats); score 8: rear teats inside of the quarter (crossing teats) (combined score eight; and nine)

SE = standard error

Table S34. The least squared means of udder width and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
3	2.97	2.84	2.84	2.90	2.77	2.90	2.96	2.97	3.09	3.21	0.08–0.09
4	2.92	2.63	2.62	2.76	2.73	2.82	2.89	2.85	2.96	3.18	0.04–0.05
5	2.94	2.61	2.61	2.72	2.75	2.85	2.92	2.94	3.02	3.12	0.03–0.04
6	2.87	2.60	2.63	2.72	2.82	2.85	2.91	2.96	3.05	3.12	0.03–0.04
7	2.89	2.70	2.70	2.69	2.80	2.91	2.95	3.00	3.14	3.25	0.04
8	2.92	2.64	2.70	2.92	2.91	3.04	3.11	3.09	3.20	3.31	0.05–0.06
9	3.10	2.63	2.92	2.93	3.20	3.05	3.19	3.24	3.35	3.51	0.10–0.12

All values are significant at $P < 0.01$

Score 3: udder width 6–8 cm (combined score one, two, and three); score 4: udder width 8–9 cm; score 5: udder width 9–9.5 cm; score 6: udder width 10 cm; score 7: udder width 10.5 cm; score 8: udder width 11 cm and score 9: udder width 12 cm (combined score eight; and nine)

SE = standard error

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Table S35. The least squared means of body condition and somatic cell score in different lactation periods by 30 days in milk

Score	0–30	30–60	60–90	90–120	120–150	150–180	180–210	210–240	240–270	270–300	SE
3	3.03	2.74	2.76	2.86	2.91	2.96	3.02	3.07	3.09	3.29	0.07–0.08
4	2.83	2.62	2.68	2.76	2.79	2.90	2.98	2.96	3.08	3.20	0.04
5	2.88	2.61	2.60	2.67	2.75	2.82	2.90	2.94	3.07	3.16	0.03
6	2.89	2.67	2.63	2.75	2.79	2.85	2.95	2.90	3.00	3.14	0.04
7	2.97	2.66	2.57	2.78	2.79	2.79	2.86	2.84	2.93	3.17	0.07–0.08
8	3.01	2.81	2.94	2.89	2.81	3.04	3.11	3.00	3.13	3.15	0.13–0.15

All values are significant at $P < 0.01$

Score 3: body condition score 1–2 (combined score one, two, and three); score 4: body condition score 2–2.5; score 5: body condition score 2.5–3; score 6: body condition score 3–3.5; score 7: body condition score 3.5–4 and score 8: body condition score 5 (combined score eight and nine)

SE = standard error