Effects of common diseases on rumination time in high-productive Holstein dairy cows

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Supplementary File

Disease	Interval	Numcows	case-control ratio	Mean RT (absence)	Mean RT (presence)	Mean difference	p-value
Generic diseases	2-h	126	1:2.35	47.00	45.73	1.27	< 0.001
Reproductive diseases	2-h	66	1:0.85	46.92	45.84	1.08	< 0.001
Mastitis	2-h	68	1:39.51	47.43	42.59	4.84	< 0.001
Locomotor issues	2-h	16	1:34.51	45.59	43.19	2.40	0.001
Gastroenteric diseases[1]	2-h	3	1:14.49	47.67	37.76	9.91	< 0.001

[1] Only three animals suffered from gastroenteric diseases, therefore, even if highly significant, caution should be used with this result.

Table S1. Differences between the mean Rumination Time (RT, expressed in min/2h) in absence or presence of the disease and their t-test p-value.

a) Generic disease

Window size	Mean		SD		Slope	
	Before	After	Before	After	Before	After
1	42.01 ± 11.47	41.28 ± 10.21	9.61 ± 5.36	9.56 ± 5.75	-4.84^{a} ± 7.00	-2.39^{b} ± 7.01
3	43.83 ± 7.96	43.51 ± 7.82	10.54 ± 3.87	10.36 ± 3.43	-1.04^{a} ± 1.72	0.29^{b} ± 1.54
5	44.62 ± 6.90	44.61 ± 6.89	10.35 ± 3.34	10.17 ± 2.80	-0.54^{a} ± 0.78	0.28^{b} ± 0.81

b) Reproductive diseases

Window size	Mean		SD		Slope	
	Before	After	Before	After	Before	After
1	42.53 ± 11.13	43.29 ± 8.82	9.11 ± 4.73	7.91 ± 4.12	-3.56 ± 6.75	-3.60 ± 5.63
3	44.71 ± 7.21	43.39 ± 6.58	10.31 ± 4.45	9.16 ± 3.22	-1.23^{a} ± 1.82	-0.38^{b} ± 1.46
5	45.29 ± 6.05	43.86 ± 6.63	10.01 ± 3.61	9.26 ± 2.46	-0.52^{a} ± 0.81	-0.04^{b} ± 0.62

c) Mastitis

Window size	Mean		SD		Slope	
	Before	After	Before	After	Before	After
1	43.95^{a} ± 9.36	41.30^{b} ± 9.76	10.05 ± 5.98	11.19 ± 6.65	-5.64^{a} ± 6.50	-2.54^{b} ± 8.29
3	44.65 ± 6.72	43.73 ± 7.67	10.57 ± 3.68	11.11 ± 3.63	-0.77^{a} ± 1.53	0.33^{b} ± 1.40
5	45.33 ± 6.17	45.08 ± 6.35	10.51 ± 3.17	10.82± 2.89	-0.41^{a} ± 0.67	0.34^{b} ± 0.85

d) Locomotor system issues

Window size	Mean		SD		Slope	
	Before	After	Before	After	Before	After
1	35.15 ± 12.42	38.35 ± 10.47	7.06 ± 3.75	8.39 ± 3.97	-3.41 ± 4.61	-0.17 ± 5.76
3	36.94 ± 8.61	42.15 ± 7.38	9.78 ± 3.37	9.61 ± 2.79	-0.79^{a} ± 1.49	0.95^{b} ± 1.62
5	37.76^{a} ± 6.95	42.51^{b} ± 5.86	10.17 ± 2.67	9.59 ± 2.55	-0.64^{a} ± 0.70	0.46^{b} ± 0.72

e) Gastroenteric diseases

Window size	Mean		SD		Slope	
	Before	After	Before	After	Before	After
1	19.81 ± 8.76	28.00 ± 12.72	14.15 ± 7.91	10.83 ± 8.05	-7.13 ± 16.26	2.83 ± 4.58
3	35.78 ± 6.23	36.47 ± 16.96	16.32 ± 3.66	11.28 ± 5.84	-4.55^{a} ± 0.83	1.55^{b} ± 1.75
5	39.51 ± 5.50	38.21 ± 16.31	15.56 ± 4.57	11.14 ± 4.28	-2.22^{a} ± 0.43	0.75^{b} ± 0.13

Table S2. Mean ± SD of rumination mean, rumination SD, and slope (from the regression line) before and after different sanitary events (a – e). The differences between before and after the events were tested using t-test (row by row and couple-wise): the superscripts (i.e., a and b) identify the couples which elements were significantly different ($P < 0.05$).

a) Generic disease

Window size	Disease = RT mean				Disease = RT sd				Disease = RT slope				Disease = RT mean + RT sd + RT slope							
	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	mean Estimate	Odds ratio	sd Estimate	Odds ratio	slope Estimate	Odds ratio	AIC	Pseudo R^2
1	-0.079 (0.009) p < 0.001	0.92	2096.9	2.99%	0.009 (0.017) ns	1.01	2161.1	0.01%	-0.087 (0.011) p < 0.001	0.92	2096.6	3.01%	-0.076 (0.009) p < 0.001	0.93	-0.038 (0.019) ns	0.96	-0.099 (0.014) p < 0.001	0.91	2034.4	6.07%
3	-0.073 (0.012) p < 0.001	0.93	2096.4	1.69%	0.115 (0.025) p < 0.001	1.12	2112.2	0.95%	-0.654 (0.052) p < 0.001	0.52	2016.7	5.43%	-0.054 (0.012) p < 0.001	0.95	0.021 (0.028) ns	1.02	-0.555 (0.066) p < 0.001	0.57	1999.2	6.45%
5	-0.061 (0.013) p < 0.001	0.94	2069.6	1.04%	0.119 (0.029) p < 0.001	1.13	2075.5	0.76%	-1.379 (0.104) p < 0.001	0.25	1965.6	6.02%	-0.039 (0.013) p = 0.002	0.96	-0.000 (0.033) ns	1.00	-1.280 (0.138) p < 0.001	0.28	1960.1	6.47%

b) Reproductive diseases

Window size	Disease = RT mean				Disease = RT sd				Disease = RT slope				Disease = RT mean + RT sd + RT slope							
	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	mean Estimate	Odds ratio	sd Estimate	Odds ratio	slope Estimate	Odds ratio	AIC	Pseudo R^2
1	-0.065 (0.016) p < 0.001	0.94	708.6	2.11%	- 0.024(0.030) ns	0.98	723.2	0.09%	-0.062 (0.019) p < 0.001	0.94	712.6	1.56%	-0.064 (0.016) p < 0.001	0.94	-0.046 (0.033) ns	0.96	-0.076 (0.023) p < 0.001	0.93	699.3	3.96%
3	-0.047 (0.021) p = 0.022	0.95	693.0	0.73%	0.072 (0.046) ns	1.08	695.7	0.34%	-0.662 (0.082) p < 0.001	0.52	652.3	6.59%	-0.028 (0.020) ns	0.97	-0.071 (0.053) ns	0.93	-0.752 (0.128) p < 0.001	0.47	652.4	7.16%
5	-0.039 (0.022) ns	0.96	693.5	0.44%	0.045 (0.055) ns	1.05	695.9	0.10%	-1.314 (0.190) p < 0.001	0.27	660.1	5.27%	-0.023 (0.022) ns	0.98	-0.071 (0.060) ns	0.93	-1.453 (0.256) p < 0.001	0.23	661.2	5.68%

Table S3. Summary of the logistic regression models' output: from **a)** to **e)** the 5 cases (i.e., generic diseases, reproductive diseases, mastitis, locomotor system issues, and gastroenteric diseases) with their estimates of the β (value, SE in brackets, and the p-value), odds ratio, AIC (Akaike information criterion)of the model, andMcFadden's Pseudo-R^2.

c) Mastitis

Window size	Disease = RT mean				Disease = RT sd				Disease = RT slope				Disease = RT mean + RT sd + RT slope							
	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	mean Estimate	Odds ratio	sd Estimate	Odds ratio	slope Estimate	Odds ratio	AIC	Pseudo R^2
1	-0.059 (0.011) p < 0.001	0.94	1565.6	1.50%	0.029 (0.019) ns	1.03	1586.9	0.15%	-0.101 (0.013) p < 0.001	0.90	1524.4	4.10%	-0.056 (0.011) p < 0.001	0.95	-0.033 (0.023) ns	0.97	-0.114 (0.017) p < 0.001	0.89	1504.4	5.61%
3	-0.064 (0.014) p < 0.001	0.94	1565.2	1.27%	0.120 (0.028) p < 0.001	1.13	1568.3	1.08%	-0.549 (0.069) p < 0.001	0.58	1533.8	3.26%	-0.050 (0.013) p < 0.001	0.95	0.067 (0.030) p = 0.026	1.07	-0.411 (0.072) p < 0.001	0.66	1518.8	4.46%
5	-0.053 (0.015) p = 0.001	0.95	1545.4	0.77%	0.141 (0.032) p < 0.001	1.15	1539.6	1.14%	-1.171 (0.129) p < 0.001	0.31	1497.2	3.87%	-0.037 (0.015) p = 0.011	0.96	0.068 (0.035) p = 0.049	1.07	-0.921 (0.147) p < 0.001	0.40	1490.6	4.56%

d) Locomotor system issues

Window size	Disease = RT mean				Disease = RT sd				Disease = RT slope				Disease = RT mean + RT sd + RT slope							
	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	mean Estimate	Odds ratio	sd Estimate	Odds ratio	slope Estimate	Odds ratio	AIC	Pseudo R^2
1	-0.133 (0.021) p < 0.001	0.88	240.5	11.07%	-0.108 (0.060) ns	0.90	266.3	1.37%	-0.067 (0.033) p = 0.043	0.94	265.8	1.53%	-0.130 (0.021) p < 0.001	0.88	-0.165 (0.071) p = 0.020	0.85	-0.119 (0.054) p = 0.028	0.89	234.3	14.88%
3	-0.182 (0.031) p < 0.001	0.83	238.0	11.80%	0.076 (0.076) ns	1.08	268.4	0.34%	-0.532 (0.162) p = 0.001	0.59	261.1	3.08%	-0.177 (0.032) p < 0.001	0.84	-0.051 (0.081) ns	0.95	-0.374 (0.182) p = 0.040	0.69	237.2	13.62%
5	-0.196 (0.036) p < 0.001	0.82	227.6	11.22%	0.144 (0.084) ns	1.16	253.3	1.02%	-1.443 (0.265) p < 0.001	0.24	237.2	7.42%	-0.179 (0.038) p < 0.001	0.84	-0.075 (0.106) ns	0.93	-1.267 (0.411) p = 0.002	0.28	219.2	16.17%

e) Gastroenteric diseases

Window size	Disease = RT mean				Disease = RT sd				Disease = RT slope				Disease = RT mean + RT sd + RT slope							
	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	Estimate	Odds ratio	AIC	Pseudo R^2	mean Estimate	Odds ratio	sd Estimate	Odds ratio	slope Estimate	Odds ratio	AIC	Pseudo R^2
1	-0.235 (0.060) p < 0.001	0.79	26.9	49.02%	0.182 (0.091) p = 0.046	1.20	45.6	7.21%	-0.135 (0.077) ns	0.87	46.0	6.51%	-0.264 (0.080) p = 0.001	0.77	0.171 (0.122) ns	1.19	-0.056 (0.065) ns	0.95	26.5	58.81%
3	-0.188 (0.061) p = 0.002	0.83	41.2	17.00%	0.450 (0.125) p < 0.001	1.57	37.3	25.76%	-1.139 (0.269) p < 0.001	0.32	29.6	42.78%	-0.221 (0.102) p = 0.030	0.80	-0.554 (0.562) ns	0.58	-2.497 (1.474) ns	0.08	26.5	58.64%
5	-0.173 (0.074) p = 0.020	0.84	44.1	10.18%	0.464 (0.135) p < 0.001	1.59	38.2	23.39%	-2.347 (0.585) p < 0.001	0.10	30.1	41.54%	-0.063 (0.092) ns	0.94	-0.125 (0.328) ns	0.88	-2.697 (1.537) ns	0.07	33.1	43.89%

Table S3 (continued). Summary of the logistic regression models' output: from **a)** to **e)** the 5 cases (i.e., generic diseases, reproductive diseases, mastitis, locomotor system issues, and gastroenteric diseases) with their estimates of the β (value, SE in brackets, and the p-value), odds ratio, AIC (Akaike information criterion)of the model, andMcFadden's Pseudo-R^2.