Application of trends in body weight measurements to predict changes in body condition score

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Abstract

Body weight and body condition score (BCS) are both related to the physical condition of dairy cows. Body weight can be measured automatically; automatic measurement of BCS is under development but not yet common in practice. Body weight and BCS are related but this relation is not straightforward. Experimental data were used to explore the relation between body weight and BCS of dairy cows. Body weight measurements of 148 dairy cows on an experimental farm during one year were available. BCS recordings were available per cow every four weeks. The objective of this research was to detect unwanted changes in BCS (sharp decline after calving, excessive rise at end of lactation) based on measurements of body weight. The body weight values were modelled, per cow and lactation, by a local trend model by applying dynamic linear modelling. This resulted in estimates of the level and trend of the body weight combined with confidence intervals. The non-zero trends in body weight were used to detect level changes in BCS. This method might be used to detect a fall in BCS after calving; however it is not specific enough to detect an excessive rise in BCS at the end of a lactation.

Keywords: body weight, body condition score, dynamic linear model

Introduction

The body condition score (BCS) of a dairy cow is an assessment of the proportion of body fat that is possesses, the BCS is an important factor in dairy management (Roche *et al.*, 2009). The BCS is scored on a 1-5 scale; this 5-point system is standard for dairy cattle. The scoring includes both a visual and tactile appraisal. Automated body condition scoring is subject of research but not commonly used in practice yet. A BCS of 1 indicates emaciated, 3 is average and 5 is obese. A score of 3.5-4 is desired (McNamara, 2011). Extreme scores (1 or 5) should be avoided. The intercalving BCS profile is similar to an inverted milk lactation curve, declining to a nadir at 40 to 100 d after calving as milk production peaks, before replenishing lost body as the milk lactation profile declines (Roche *et al.*, 2009). BCS values should be compared within-cow. The BCS loss after calving and before peak production should be no more than 1-1.5 units (McNamara, 2011) and should not fall below 2.5 (Roche *et al.*, 2009). At the

end of a lactation and during the dry period, the BCS should not rise above 4.
Body weight and BCS are related but this relation is not straightforward. This relation has been subject of extensive research, e.g. Berry *et al.* (2006), Buckley *et al.* (2003) and Thorup *et al.* (2012). BCS is indicator of the fattiness of a cow, the presence of a calve influences the cow's body weight but not necessarily the BCS. The body weight fluctuates during the day due to several influences (e.g. drinking bouts, urinating, milking).
The objective of this research was to detect unwanted changes in BCS (sharp decline after calving, excessive rise at end of lactation) based on measurements of body weight. This method is advantageous as body weight can be measured automatically while BCS has to be recorded by visual observations.

Material and methods

Measurements of body weight of 148 dairy cows at the Dairy research farm "De Waiboerhoeve", of Wageningen UR Livestock Research in Lelystad, the Netherlands during one year (May 2011–April 2012) were available. The cows were housed without grazing in a free-stall barn with individual cubicles and a concrete slatted floor. The cows were milked twice a day in a ten stands open tandem milking parlour with electronic cow identification and milk flow recording. Body weight was measured automatically on entrance to the milking parlour during lactation and furthermore twice a week in the dry period. BCS recordings were available per cow every four weeks. Cow calendar data and recordings of cases of oestrus and diseases were available from the farm management system.
The model used to describe the body weight reflected the fact that the weight on successive milkings was related but might change over time. A linear trend model was used, where the weight shows a certain level that is changing in the course of time due to a linear trend:

$$W_m = \mu_m + \nu_m, \quad (1)$$

$$\mu_m = \mu_{m-1} + \alpha_{m-1} + \omega_{1m}, \quad (2)$$

$$\alpha_t = \alpha_{t-1} + \omega_{2m}, \quad (3)$$

where:
W_m = observed weight at milking m;
μ_m = level at milking m;
α_m = linear trend at milking m;
ν_m = observational error;
ω_{im} = system error (i = 1, 2).

The parameters in the linear trend model were time-dependent to reflect that they might change with time. The values of the parameters in the linear trend model should be known to be able to use this model for detection purposes, therefore the parameters were fitted on-line with a dynamic linear model (DLM) as in de Mol *et al.* (2013). This resulted in fitted values of the level and trend (with confidence interval) per milking for each cow and lactation. An example of the available data and the fitted parameters is given in Figure 1. The cow in Figure 1 was in her third lactation after February 2, 2011 till the dry period starting on November 24. She calved again on January 16, 2012 (day 381 since 1/1/2011). The fitted values for the weight level with confidence interval are included in the top left graph, the fitted values for the weight trend with confidence interval are included the middle right graph. For the analysis it was assumed that the trend is positive when the lower boundary of the confidence interval was above zero (e.g. at day 300); it was negative when the upper bound of the confidence interval was below zero (e.g. at day 400).

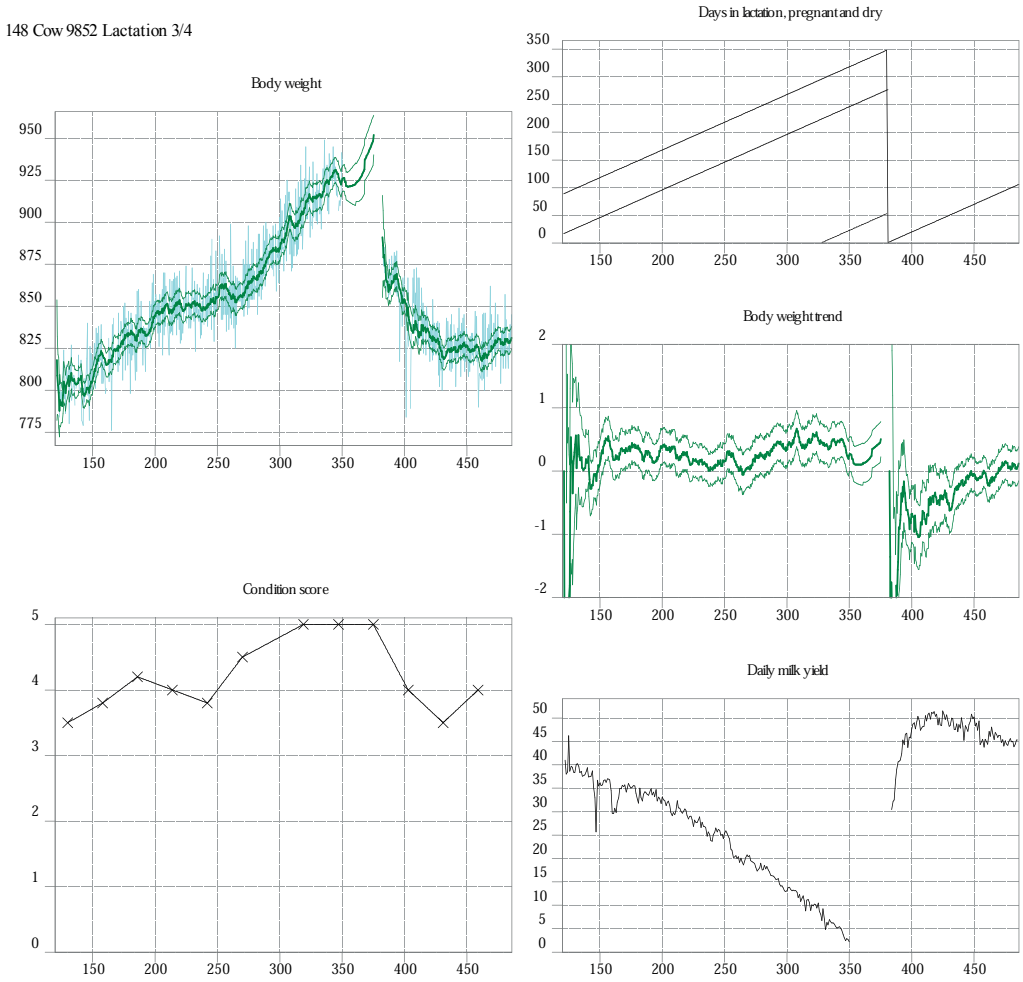

Figure 1: Example of the available data and fitted parameters for the 148th cow per milking (day since 1/1/2011 at horizontal axis), top left: body weight per milking with fitted level and confidence interval; bottom left: BCS; top right: cow status: days in lactation (solid line), pregnant days (striped) and dry days (dotted); middle right: fitted trend and confidence interval; bottom: right milk yield per day; further explanation in text

The analysis was focussed on cows with:

- more than 1 point decline in BCS after calving;
- excessive rise at end of lactation resulting in a BCS of more than 4.

These cows should be alerted and the farmer should keep an eye on them. The detection method was based on the number of successive days with a positive or negative trend and the maximum level of the trend during these days:

- a cow was alerted after calving when:
  - the number of days with a negative trend was at least 14 or
  - the number of days with a negative trend was less than 14 but at least 7 days and the minimum level was less than -1.
- a cow was alerted at the end of a lactation when:
  - the number of days with a positive trend was at least 28 or
  - the number of days with a positive trend was less than 28 but at least 14 days and the maximum level was more than -0.5.

The BCS of cow 9852 (Figure 1) rose up to 5 at the end of lactation 3, the model alerted for that as the number of successive days with a positive trend was 62 (with a maximum of 0.7). This cow had also more than one point decline in BCS in the beginning of lactation 4; the model alerted for that as the number of successive days with a negative trend was 18 (with a minimum of -3.6).
Each lactation with a decline in the beginning (or a rise at the end) was True Positive (TP) when the model generated an alert for it; otherwise it was False Negative (FN). A lactation without a decline in the beginning (or a rise at the end) was False Positive (FP) when the model generated an alert; otherwise it was True Negative (TN).

Results and discussion

Measurements of body weight and BCS of 148 cows during one year were available. These data included:

- 115 cows at the beginning of a lactation with the peak production included, of which 52 (45%) with a decline in the beginning;
- 137 cows at the end of a lactation, of which 41 (30%) reached a BCS level above 4.

The detection results are included in Table 1 (beginnings of lactation) and Table 2 (ends of lactation). Detailed results per cow are given in the annex.

Table 1: Analysis results for the 115 beginnings of lactation in the dataset

	decline in BCS more than 1	decline in BCS less than 1
alert for decline	TP: 50	FP: 37
no alert for decline	FN: 2	TN: 26

There were 52 lactations with a sharp decline in the beginning, 50 were detected, so the sensitivity (percentage of detected cases) was 96%. Also 37 of the 63 cases without a sharp decline were alerted, so the specificity (the percentage truly not detected cases) was rather low: 41%.

Table 2: Analysis results for the 137 ends of lactation in the dataset

	level of BCS more than 4	level of BCS not more than 4
alert for increase	TP: 39	FP: 81
no alert for increase	FN: 2	TN: 15

There were 41 lactations where the BCS became more than 4 at the end, 39 were detected, so the sensitivity (percentage of detected cases) was 95%. Also 81 of the 96 cases where the BCS became not more than 4 were alerted, so the specificity (the percentage truly not detected cases) was extreme low: 16%.

Conclusions

A decline in BCS at the beginning of a lactation can be detected by a negative trend in body weight. An alert can be false positive, but a cow without an alert on weight has almost sure no problems with the BCS, An unwanted peak in the BCS at the end of a lactation is more difficult to detect by changes in the body weight because almost all cows do have a positive trend in this stage.

Acknowledgements

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Annex: Per cow, left: analysis of end of lactation, right: analysis of begin of lactation

number	cow	lactation	BCS from	BCS to	nr of days with positive trend	maximum level	alert	classification	lactation	BCS from	BCS to	BCS change	nr of days with negative trend	minimum trend	alert	classification
1	1033	3	4.00	3.00	64	0.7	1	FP	4	3.00	1.25	-1.75	46	-6.8	1	TP
2	1180	6	2.50	2.50	0	-0.3	0	TN	7	2.00	1.00	-1.00	4	-0.3	0	TN
3	2047	8	3.50	3.00	41	0.7	1	FP	9	3.00	2.00	-1.00	17	-12.3	1	FP
4	2124	3	4.00	5.00	99	1.3	1	TP	4	5.00	3.00	-2.00	72	-12.1	1	TP
5	2156	3	3.00	2.75	17	0.6	1	FP	4	2.75	2.00	-0.75	14	-3.4	1	FP
6	2165	4	3.00	4.00	50	0.8	1	FP	4						0	
7	2200	2	3.50	4.25	36	0.6	1	TP	3	4.25	2.50	-1.75	45	-2.0	1	TP
8	2220	2	3.25	3.50	26	1.8	1	FP	3	3.50	1.75	-1.75	51	-1.9	1	TP
9	2238	2					0		3	3.00	1.50	-1.50	25	-1.4	1	TP
10	2244	3	3.00	3.50	71	0.9	1	FP	4						0	
11	2246	3	2.25	3.50	27	0.8	1	FP	4						0	
12	2281	2					0		3	2.25	1.50	-0.75	12	-3.1	1	FP
13	2544	3	3.75	4.50	53	0.7	1	TP	4	3.25	2.75	-0.50	41	-3.8	1	FP
14	3289	7	2.50	3.00	20	0.4	0	TN	7			0.00			0	TN
15	3478	5	2.00	3.00	50	0.6	1	FP	6	3.00	2.25	-0.75	8	-7.4	1	FP
16	3522	5	3.50	4.75	25	0.7	1	TP	6	3.75	3.00	-0.75	10	-9.1	1	FP
17	3527	6	2.50	3.00	86	0.8	1	FP	7	3.00	1.50	-1.50	7	-10.9	1	TP
18	3530	5	1.00	1.75	22	0.5	1	FP	6	1.75	1.00	-0.75	16	-4.9	1	FP
19	3604	5	1.25	1.50	10	0.5	0	TN	6	1.50	1.00	-0.50	2	-6.6	0	TN
20	3672	5	1.75	2.25	18	0.5	1	FP	6	2.25	1.25	-1.00	4	-13.0	0	TN
21	3675	4	1.75	3.00	43	1.2	1	FP	5	3.00	2.00	-1.00	3	-1.3	0	TN
22	3699	4	2.25	2.75	30	0.9	1	FP	5	2.75	2.25	-0.50	23	-1.2	1	FP
23	3707	5	3.25	4.00	81	0.8	1	FP	6	4.00	3.00	-1.00	26	-1.1	1	FP
24	3721	5	3.00	3.25	37	0.8	1	FP	6	3.25	2.00	-1.25	25	-1.9	1	TP
25	3727	4	1.50	2.00	4	0.3	0	TN	4						0	
26	3740	4	2.50	3.00	37	0.6	1	FP	5	3.00	2.00	-1.00	15	-1.0	1	FP
27	3751	5	3.25	3.75	29	0.7	1	FP	5						0	
28	3756	4	2.50	3.50	43	0.7	1	FP	4						0	
29	3778	3	2.75	3.25	38	0.8	1	FP	4	3.25	1.25	-2.00	26	-2.3	1	TP
30	3833	3	3.50	4.25	42	0.6	1	TP	4	3.50	1.50	-2.00	15	-6.2	1	TP
31	3853	2	2.00	3.50	44	0.7	1	FP	3	3.50	2.00	-1.50	20	-6.7	1	TP
32	3857	3	2.25	3.00	24	0.5	1	FP	3						0	
33	3872	2	3.00	5.00	94	0.7	1	TP	2						0	
34	3874	2	2.00	2.00	52	0.9	1	FP	3	2.00	3.50	1.50	0	0.0	0	TN

number	cow	lactation	BCS from	BCS to	nr of days with positive trend	maximum level	alert	classification	lactation	BCS from	BCS to	BCS change	nr of days with negative trend	minimum trend	alert	classification
35	3875	2	2.00	3.00	7	0.4	0	TN	2						0	
36	3919	4	3.00	3.50	29	0.5	1	FP	5	3.25	3.50	0.25	7	-1.8	1	FP
37	3920	2					0		3	3.50	2.50	-1.00	6	-2.3	0	TN
38	3925	3	2.25	3.00	47	0.8	1	FP	4	3.25	1.75	-1.50	36	-3.1	1	TP
39	3926	4	4.50	5.00	25	1.5	1		5	5.00	2.00	-3.00	23	-1.0	1	TP
40	3933	3					0		4	2.75	1.75	-1.00	10	-3.5	1	FP
41	3940	5	2.00	2.50	6	34.0	0	TN	6	2.50	1.25	-1.25	15	-5.0	1	TP
42	3949	3	4.50	5.00	69	0.8	1	TP	4						0	
43	3968	2	4.50	4.00	21	0.6	1	FP	3	4.00	2.75	-1.25	51	-6.7	1	TP
44	3975	2	2.50	3.00	17	0.9	1	FP	3	3.00	2.25	-0.75	38	-1.4	1	FP
45	3990	2	3.25	4.00	60	0.5	1	FP	3	4.00	3.00	-1.00	5	-2.5	0	TN
46	3993	2	2.75	3.50	89	0.8	1	FP	3	3.50	1.75	-1.75	33	-0.6	1	TP
47	4001	2	3.25	3.50	30	0.4	1	FP	3	3.25	2.25	-1.00	37	-7.8	1	FP
48	4008	4	3.50	4.00	9	0.3	0	TN	4						0	
49	4038	4	3.50	4.50	50	0.5	1	TP	5						0	
50	4199	4	1.00	1.50	59	10.7	1	FP	5	1.50	2.00	0.50	6	-0.7	0	TN
51	4210	4	3.00	3.50	36	0.7	1	FP	5	3.50	2.25	-1.25	26	-2.3	1	TP
52	4276	3	2.50	3.25	41	0.5	1	FP	4	3.00	3.50	0.50	4	-12.3	0	TN
53	4282	4	2.75	4.75	40	0.8	1	TP	5	4.75	3.50	-1.25	19	-1.4	1	TP
54	4298	4	2.75	3.25	35	1.1	1	FP	5	3.25	3.00	-0.25	19	-3.1	1	FP
55	4310	4	3.00	3.50	21	0.7	1	FP	5	3.50	3.00	-0.50	15	-12.7	1	FP
56	4332	3	2.50	2.25	21	2.3	1	FP	4	2.25	1.75	-0.50	29	-2.8	1	FP
57	4341	4	2.50	3.00	14	0.4	0	TN	5	2.75	2.00	-0.75	5	-20.1	0	TN
58	4359	4	2.00	3.25	32	0.9	1	FP	5	2.50	1.00	-1.50	32	-5.6	1	TP
59	4430	4	3.00	4.50	38	0.8	1		4						0	
60	4458	3					0		4	3.25	2.50	-0.75	2	-11.2	0	TN
61	4647	3	3.00	3.50	40	0.7	1	FP	4	3.50	2.25	-1.25	39	-5.3	1	TP
62	4669	2					0		3	3.00	2.00	-1.00	29	-1.3	1	FP
63	4674	3	2.50	3.25	28	0.5	1	FP	4	3.00	2.50	-0.50	17	-5.6	1	FP
64	4676	3	3.25	3.75	15	0.4	0	TN	4	3.25	1.50	-1.75	29	-1.0	1	TP
65	4682	3	3.25	4.25	15	0.5	1	TP	3						0	
66	4694	3	4.50	5.00	54	1.0	1	TP	4	5.00	3.50	-1.50	62	-9.4	1	TP
67	4712	3	2.50	3.25	55	0.8	1	FP	4	3.25	2.00	-1.25	36	-6.1	1	TP
68	4714	3	4.00	5.00	122	0.8	1	TP	4	5.00	2.50	-2.50	65	-3.9	1	TP
69	4757	3	2.50	3.00	41	0.6	1	FP	4	3.00	2.25	-0.75	23	-2.7	1	FP
70	4774	3	3.75	5.00	42	0.6	1	TP	4	5.00	2.50	-2.50	43	-6.7	1	TP
71	4792	3	3.50	5.00	94	0.6	1	TP	4	5.00	2.75	-2.25	38	-9.0	1	TP
72	4797	3	2.25	2.50	3	0.3	0	TN	3						0	
73	4801	2	2.00	2.25	18	0.4	0	TN	3	2.25	1.25	-1.00	0	0.0	0	TN
74	4805	3	3.25	3.50	56	0.6	1	FP	4	3.25	2.00	-1.25	38	-2.4	1	TP
75	4825	3	2.25	2.75	15	0.5	1	FP	4	2.75	3.00	0.25	12	-3.6	1	FP
76	4887	3	3.50	5.00	26	0.6	1	TP	3						0	
77	4890	2					0		3	3.00	2.00	-1.00	43	-1.7	1	FP
78	4894	3	3.00	3.50	20	0.7	1	FP	3						0	
79	4903	3					0	TP	3						0	

number	cow	lactation	BCS from	BCS to	nr of days with positive trend	maximum level	alert	classification	lactation	BCS from	BCS to	BCS change	nr of days with negative trend	minimum trend	alert	classification
80	4913	3	3.00	3.75	71	0.8	1	FP	3	3.50	2.50	-1.00	27	-1.7	1	FP
81	4914	2	3.00	4.00	106	0.8	1	FP	3	4.00	1.50	-2.50	54	-2.3	1	TP
82	4918	3	3.00	4.00	88	0.6	1	FP	4	3.25	1.75	-1.50	26	-1.6	1	TP
83	4919	2	3.75	3.75	35	1.8	1	FP	3	3.75	3.00	-0.75	14	-2.6	1	FP
84	4927	2	2.25	3.75	43	0.9	1	FP	3	3.75	2.00	-1.75	39	-7.2	1	TP
85	4946	3	5.00	5.00	27	0.8	1	TP	4	5.00	4.50	-0.50	25	-5.1	1	FP
86	4952	2	3.25	3.75	28	0.6	1	FP	3	3.75	3.00	-0.75	22	-1.6	1	FP
87	4953	2	2.75	3.75	51	1.2	1	FP	3	3.75	1.75	-2.00	13	-14.3	1	TP
88	4972	2	4.00	5.00	53	0.8	1	TP	3						0	
89	4974	2	3.00	4.50	45	0.9	1		3	4.50	2.50	-2.00	54	-4.9	1	TP
90	4978	2	2.00	2.25	30	1.0	1	FP	3	1.00	3.00	2.00	0	0.0	0	TN
91	4980	2	5.00	5.00	104	0.6	1	TP	3	4.00	2.25	-1.75	57	-4.5	1	TP
92	4981	2	2.25	2.00	13	0.6	0	TN	3	2.00	2.00	0.00	0	0.0	0	TN
93	4985	2	4.50	4.00	16	0.4	0	TN	3	4.00	4.00	0.00	1	-7.1	0	TN
94	4986	3	2.50	3.25	36	0.7	1	FP	4	3.25	1.25	-2.00	9	-1.5	1	TP
95	4990	2	3.00	3.25	52	1.1	1	FP	3	3.25	2.75	-0.50	4	-1.0	0	TN
96	4992	2					0		4	3.25	2.25	-1.00	24	-0.8	1	FP
97	4996	2	3.50	3.50	6	0.4	0	TN	3	3.00	2.75	-0.25	17	-2.2	1	FP
98	4998	2	4.50	5.00	113	0.6	1	TP	3	5.00	3.00	-2.00	46	-6.3	1	TP
99	5002	2	3.50	4.00	33	0.7	1	FP	3	4.00	2.00	-2.00	40	-5.8	1	TP
100	5008	2	3.50	4.00	29	2.4	1	FP	3	4.00	3.50	-0.50	4	-0.4	0	TN
101	5025	2	2.75	3.50	30	0.7	1	FP	3	3.50	1.50	-2.00	33	-2.0	1	TP
102	5040	2	2.00	3.50	74	1.1	1	FP	3	3.50	2.50	-1.00	4	-2.3	0	TN
103	5042	2	3.50	3.75	79	0.7	1	FP	3	2.50	3.00	0.50	3	-10.0	0	TN
104	5045	2	3.75	5.00	58	0.7	1		3	4.00	2.25	-1.75	52	-7.7	1	TP
105	5058	2	4.50	5.00	89	0.7	1		3						0	
106	5059	2	2.75	3.00	55	0.9	1	FP	3	3.00	2.25	-0.75	6	-5.0	0	TN
107	5067	2					0		3	3.00	2.00	-1.00	26	-3.6	1	FP
108	5092	2					0		2						0	
109	5097	2	3.50	5.00	78	0.7	1		3						0	
110	5131	2	2.00	3.50	29	0.7	1	FP	3	3.50	1.25	-2.25	34	-5.9	1	TP
111	5133	2	4.50	5.00	110	0.7	1	TP	3	5.00	3.25	-1.75	69	-6.6	1	TP
112	5136	2	2.00	4.25	54	0.6	1	TP	3	4.25	1.75	-2.50	30	-11.3	1	TP
113	5141	2	3.00	3.50	86	0.7	1	FP	3	3.00	2.00	-1.00	54	-5.4	1	FP
114	5143	2	4.75	5.00	52	0.7	1	TP	3	3.50	2.25	-1.25	21	-0.9	1	TP
115	5153	2	3.25	4.50	25	0.4	0	FN	3	3.25	3.00	-0.25	13	-2.0	1	FP
116	5158	2	4.50	5.00	59	0.4	1	TP	3						0	
117	5169	2	3.00	2.50	61	1.3	1	FP	3	2.50	2.00	-0.50	4	-13.9	0	TN
118	5173	2	2.00	3.00	50	1.1	1	FP	3	3.00	2.25	-0.75	20	-4.5	1	FP
119	5179	2	4.50	5.00	57	0.6	1		3	5.00	4.00	-1.00	30	-12.8	1	FP
120	5183	2	3.00	4.25	22	0.6	1	TP	3	4.25	2.00	-2.25	21	-7.8	1	TP
121	5187	2	3.00	3.50	64	0.9	1	FP	3	3.50	3.00	-0.50	1	-0.8	0	TN
122	5198	2	2.00	3.00	30	0.7	1	FP	3	3.00	1.25	-1.75	42	-4.1	1	TP
123	5200	2	1.75	2.50	39	0.8	1	FP	3	2.50	1.00	-1.50	3	-8.5	0	FN
124	5201	2	3.75	5.00	84	1.0	1	TP	3	4.50	3.50	-1.00	20	-1.8	1	FP

number	cow	lactation	BCS from	BCS to	nr of days with positive trend	maximum level	alert	classification	lactation	BCS from	BCS to	BCS change	nr of days with negative trend	minimum trend	alert	classification
125	5204	2	4.00	5.00	92	0.6	1	TP	3	3.50	2.00	-1.50	54	-14.0	1	TP
126	5209	2	4.00	4.50	76	0.8	1	TP	3	4.50	2.75	-1.75	22	-0.7	1	TP
127	5216	2	2.25	3.25	36	0.7	1	FP	3	3.00	2.00	-1.00	33	-3.6	1	FP
128	5219	2	3.00	2.75	22	0.8	1	FP	3	2.75	2.50	-0.25	32	-1.3	1	FP
129	5228	2	2.75	3.50	70	0.9	1	FP	3						0	
130	5235	2	2.00	2.75	25	0.9	1	FP	3	2.75	2.00	-0.75	19	-3.8	1	FP
131	5236	2	2.00	3.00	26	0.5	1	FP	3	3.00	3.25	0.25	0	0.0	0	TN
132	5256	2	4.50	5.00	20	0.4	0	FN	2						0	
133	5272	2	1.50	2.25	3	0.2	0	TN	2						0	
134	5275	2	3.50	5.00	103	0.9	1	TP	3						0	
135	5276	2	3.25	3.50	57	0.8	1	FP	3	3.50	2.25	-1.25	7	-0.9	0	FN
136	5279	2	2.50	4.00	104	1.0	1	FP	3	4.00	2.25	-1.75	17	-2.9	1	TP
137	5289	2	2.25	3.50	47	0.5	1	FP	3	3.50	2.75	-0.75	10	-0.8	0	TN
138	5291	2	4.00	5.00	34	2.0	1	TP	2						0	
139	5321	2	3.50	4.75	19	0.8	1	TP	2	3.00	2.75	-0.25	9	-0.6	0	TN
140	5340	2	2.75	4.00	29	0.7	1	FP	2						0	
141	5384	2	4.50	5.00	64	0.7	1	TP	2						0	
142	5402	1	2.50	2.75	33	0.9	1	FP	2	2.75	1.50	-1.25	32	-2.3	1	TP
143	5442	2	3.00	4.00	87	0.8	1	FP	2						0	
144	5465	2	2.00	2.75	29	0.8	1	FP	2	3.00	1.75	-1.25	11	-1.2	1	TP
145	9286	3	3.50	3.50	64	0.7	1	FP	4	3.50	2.00	-1.50	43	-2.5	1	TP
146	9685	5	2.00	2.50	33	0.8	1	FP	5						0	
147	9712	5	2.50	3.00	20	0.6	1	FP	5						0	
148	9852	3	3.75	5.00	62	0.7	1	TP	4	5.00	3.50	-1.50	18	-3.6	1	TP