Eating and rumination activities two weeks prepartum to one month postpartum in 100 healthy cows and cows with peripartum diseases

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Summary

Eating and rumination activities were investigated in 100 cows from 14 days prepartum to 30 days postpartum. All cows were clinically healthy at the start of the study. A pressure sensor incorporated into the noseband of a halter was used to record jaw movements, which allowed the quantification of the daily duration of eating and rumination, number of regurgitated cuds and number of chewing cycles per cud. The cows were retrospectively divided into 2 main groups healthy (n = 24) and ill cows (n = 76), and the latter were further divided into the following subgroups: cows with periparturient paresis (n = 12), retained placenta (n = 13), metritis (n = 17), primary ketosis (n = 19) and lameness (n = 6). Healthy cows had the shortest eating and rumination times on the day of calving; duration of eating decreased continually before and increased steadily after calving. In contrast, duration of rumination varied little except for a significant drop on the days of calving. Compared with healthy cows, eating times of ill cows were significantly shorter before and after calving and rumination time was reduced on days 2 to 4 postpartum. The duration of eating differed between healthy and ill cows before calving, and therefore the usefulness of eating and rumination variables for early recognition of periparturient diseases in cows requires further investigation.

Keywords: cattle, eating, rumination, transitional period, periparturient diseases

Fressen und Wiederkauen bei 100 gesunden und peripartal erkrankten Kühen 14 Tage ante bis 30 Tage post partum

In der vorliegenden Arbeit wurden die Fress- und Wiederkauparameter bei 100 initial gesunden Kühen von 14 Tagen ante bis 30 Tage post partum untersucht. Die Aufzeichnungen erfolgten mit einem druckempfindlichen Sensor, der im Nasenband eines Halfters integriert war und die Kaubewegungen registrierte. Ausgewertet wurden Fressdauer, Wiederkaudauer, Anzahl Wiederkauboli und Anzahl Kauschläge pro Wiederkaubolus. Nach Abschluss der Untersuchungen wurden die Kühe aufgrund des Gesundheitsverlaufs während der Untersuchungszeit in die 2 Hauptgruppen Gesund (n = 24) und Krank (n = 76) eingeteilt. Die kranken Kühe wurden in weitere Untergruppen aufgeteilt: Gebärparese (n = 12), Nachgeburtsverhalten (n = 13), Metritis (n = 17), primäre Ketose (n = 19) und Lahmheit (n = 6). Bei den 24 gesunden Kühen waren die Fress- und Wiederkauparameter am Tag der Geburt am niedrigsten. Dabei zeigte die Fressdauer 14 Tage vor bis zum Zeitpunkt der Geburt eine kontinuierliche Abnahme und danach eine stete Zunahme. Demgegenüber blieb die Wiederkaudauer vor und nach der Geburt im gleichen Bereich und nur am Tag der Geburt signifikant erniedrigt. Die 76 kranken Kühe wiesen ante und post partum eine signifikant kürzere Fressdauer als die gesunden Kühe auf. Die Wiederkaudauer war bei den kranken Kühen während den Tagen 2 bis 4 post partum kürzer als bei den gesunden; ansonsten zeigten sich bezüglich der Wiederkauparameter keine Unterschiede. Da sich die Fressdauer bei gesunden und kranken Kühen bereits vor der Geburt unterschied, muss weiter abgeklärt werden, ob und wie sich dieser Parameter zur frühzeitigen Erkennung von Risikotieren im peripartalen Zeitraum eignet.

Schlüsselwörter: Rind, Fressen, Wiederkauen, Transitperiode, peripartale Krankheiten

Introduction

In dairy cows, the transition period is from 3 weeks before to 3 weeks after calving and is a time when cows are at increased risk of metabolic (Goldhawk et al., 2009) and infectious diseases (Cai et al., 1994). More than 50% of dairy cows become ill within the first 30 days postpartum and many have multiple disorders including hypocalcaemia, retained placenta, metritis, ketosis and left displacement of the abomasum. These diseases often are subclinical and remain undiagnosed for extended periods of time and thus can have significant negative effects on the wellbeing and productivity of the cow (Goff and Horst, 1997; Goldhawk et al., 2009). Close monitoring of cows during the transition period, which includes monitoring of eating and rumination, aids in the early detection of subclinical problems and thus the timely initiation of treatment or management changes. Several studies have shown that eating and rumination change in the periparturient period, mainly because of altered rumen capacity, which decreases by up to a third of the normal volume because of uterine expansion at the end of gestation (Journet and Remond, 1976; Goff and Horst, 1997). It was shown that feed intake of dairy cows decreased in the last 6 weeks of gestation and reached a nadir on the day of calving (Journet and Remond, 1976). Other studies found a 35% decrease in feed intake 2 weeks prepartum and a 99% increase in the first 3 weeks of lactation (Urton et al., 2005), or a decrease 10 days prepartum and an increase 2 to 3 days postpartum (Allen et al., 2005). Parallel with feed intake, rumination diminishes in healthy dairy cows prepartum and reaches a minimum on the day of calving (Soriani et al., 2012) or on the following day (Schirmann et al. 2012). However, the rumination time and the prepartum decrease in rumination activity are subject to large individual variation (Soriani et al., 2012; Büchel and Sundrum, 2014); the drop in rumination time recorded on the day of calving ranged from 15% (Schirmann et al., 2013) to 33% (Clark et al., 2015) or 70% (Calamari et al., 2014). Other authors observed that a significant decrease (up to 25.7%) did not occur until 2 to 6 hours before calving (Büchel and Sundrum, 2014; Pahl et al., 2014; Hoy, 2015). The daily rumination time rebounds within 7 to 15 days postpartum reaching values seen before the prepartum decline and then remains more or less constant for several weeks (Journet and Remond, 1976; Soriani et al., 2012; Tschoner, 2013; Calamari et al., 2014; Hoy, 2015).

Eating and rumination variables also are useful indicators of a changing health status (Zamet et al., 1979a; Collard et al., 2000; Soriani et al., 2012). Cows with subclinical or clinically manifest postpartum disorders had shorter rumination times than healthy cows (Soriani et al., 2012; Calamari et al., 2014; Hoy, 2015). In another study, 90% of cows with a reduced rumination time 3 to 6 days postpartum became ill (Calamari et al., 2014). This means that ill cows may have a reduction in rumination time and that a reduced rumination time in the periparturient period is associated with an increased risk of subsequent disease (Soriani et al., 2012). Rebound of the rumination time postpartum is delayed in cows with periparturient disorders (Calamari et al., 2014). The goals of the present study were to characterise eating and rumination behaviours in a large number of healthy and ill dairy cows in the periparturient period and to identify differences in these variables that are associated with subsequent disease.

Animals, Material and Methods

Eating and rumination variables were investigated in 100 cows from 14 days prepartum to 30 days postpartum. The cows were then retrospectively divided into group A (healthy, n = 24) and group B (ill, n = 76). Cows of group B were subdivided (B1 to B6) according to the type of postpartum disease; the first disease diagnosed in cows with multiple disorders was referred to as the primary disease and gave rise to subgroup allocation.

Group A (healthy cows)

The 24 cows of group A were healthy throughout the study and belonged to the Brown Swiss (n = 15) and Swiss Fleckvieh (n = 9) breeds, were 4.2 ± 1 years (mean ± SD) of age and had produced 7'021 ± 1'048 kg milk in the previous lactation.

Group B (ill cows)

The 76 cows of group B suffered from one or more periparturient diseases during the study, belonged to the Brown Swiss (n = 31), Swiss Fleckvieh (n = 42) and Holstein Friesian (n = 3) breeds, were 5.7 ± 2 years of age and had produced 7'734 ± 1'506 kg milk in the previous lactation. The six subgroups were: B1, periparturient paresis; B2, retained placenta; B3, metritis; B4, primary ketosis; B5, lameness, and B6, miscellaneous disorders.

Farm management and feed rations

The cows originated from 2 tie-stall and 5 freestall operations and all had access to an exercise yard. 2 farms fed a total mixed ration (TMR) and 5 fed a partial TMR with individual concentrate feeding. The TMR consisted of haylage (16 to 67%), corn silage (25 to 54%) and hay (6 to 33%) and was supplemented with various concentrates (4 to 26%) including barley, high-moisture corn, sugar beets and canola meal. All rations were analysed; dry matter (DM) ranged from 31 to 48%, net energy for lactation from 6.1 to 6.6 MJ/kg DM, ash content from 75 to 111 g/kg DM, crude protein from

86 to 150 g/kg DM, acid detergent fibre from 171 to 242 g/kg DM, fat from 31 to 45 g/kg DM and neutral detergent fibre from 394 to 501 g/kg DM. The details for each farm have been published (Buchli, 2016).

Examinations

At the start of the examinations, all cows were clinically healthy and a mean of 21 days before the calculated due date. The cows were examined clinically every 5 (±2) days, and the findings from 10 time points, i.e., days -14, -10, -5, the day of calving, and days 5, 10, 15, 20, 25 and 30 postpartum, were used for analysis. Ketone bodies were measured in urine samples (Keto-Diastix®, Bayer-Bayer), and the concentrations of non-esterified fatty acids (NEFA; Wako NEFA C Kit, Wako Chemicals) and β-hydroxybutyrate (TDM β-Hydroxybutyrate Liquicolor®, Stanbio Laboratory) were measured in blood samples. On the day of calving, serum concentrations of calcium, inorganic phosphorus and magnesium were also measured. The laboratory analyses served to monitor metabolic disorders and have been described in detail (Buchli, 2016). All cows underwent a reproductive examination on days 10 and 25 postpartum, and eating and rumination variables were recorded continuously for 45 days starting 14 days before and ending 30 days after calving.

Recording of eating and rumination activities using a noseband pressure sensor

The recording methods used were described recently (Braun et al., 2013, 2014, 2015) and involved a pressure sensor in an oil-filled tube incorporated into the noseband of a halter (MSR Electronics, Seuzach). The sensor was activated by jaw movements; opening of the mouth caused bending of the tube and increased pressure within it. The change in mechanical pressure altered the electrical resistance in the sensor, which was recorded as a signal. Data were stored in a data logger (MSR 145 W, MSR Electronics), which was secured in a leather pouch on the side of the halter and contained a secure digital (SD) card to store the physical measurements. The SD card had a 4 GB capacity, which allowed a measuring period of 2 to 3 weeks. The data were uploaded from the logger to a personal computer and analysed every 10 to 15 days.

The data were evaluated using a special software program (V2.02.00, MSR Electronics). Eating and rumination could be easily differentiated based on their characteristic pressure profiles. So-called learning profiles comprising ten-minute sequences of each activity, in which eating and rumination were readily identifiable, were created for each cow to facilitate analysis. A so-called classifier (random forest) was then calibrated by means of the learning files and was used to identify eating and rumination activities in the recordings. A chewing cycle was identified by a peak in the pressure recording. Chewing cycles in close succession were combined into blocks (eating phases, rumination phases, rumination activity per cud). The analysis of the learning files included training of the classifier to identify chewing cycles, classification of chewing cycles and comparison with earlier classifications, identification of chewing cycles and blocks, calculation of variables for classification, classification of chewing cycles and analysis and graphical representation of the pressure recordings using a software program (Viewer2 V2.02.00, MSR Electronics). The endpoints were calculated for each cow on a daily basis and included duration of eating and rumination (minutes/day), number of regurgitated cuds and number of chewing cycles per cud.

Treatment of cows

The treatment of cows in groups B1 to B6 were described in detail (Buchli, 2016). Cows with periparturient paresis (B1) were treated intravenously with 500 ml of a 40% calcium borogluconate solution (Calcamyl-40MP, Gräub) supplemented with orally (Bovikalc, Boehringer Ingelheim) or subcutaneously administered calcium (Calcitat, Gräub) for 24 to 48 hours. Cows with retained placenta (B2) and metritis (B3) were treated with intrauterine boluses containing iodine (Vetisept, Gräub) or tetracycline (Utroletten, Vétoquinol), combined with ketoprofen (Rifen10%, Streuli Pharma) given intravenously; cows with a fever also received oxytetracycline (5 mg/kg, Engemycin, MSD Animal Health) intramuscularly. Cows with primary ketosis (B4) were treated intravenously with 500 ml of a 22 % dextrose solution (Energidex, Vétoquinol) and orally with 350 g propylene glycol (Propylenglycol, Stricker) for 3 to 5 days. Cows with sole ulcers were treated by the owners.

Reference data

The results obtained from 300 healthy cows of 3 different breeds were used for comparison (Braun et al., 2015). The reference ranges were 211 to 319 minutes for duration of eating per day, 13,'431 to 20,'722 chewing cycles per day related to eating, 370 to 511 minutes for duration of rumination per day, 484 to 672 regurgitated cuds per day and 45 to 65 chewing cycles per cud.

Statistics

The program STATA 12 (StataCorp LP, College Station, Texas, USA) was used for analysis. Data were tested for normality using the Wilk-Shapiro test. Differences among groups were analysed using one-way analysis of variance and Bonferroni post-hoc test. Differences were considered significant at $P < 0.05$. The entire study period from 14 days prepartum to 30 days postpartum was divided into 11 time points (Tab. 1).

Table 1: Daily eating times (minutes), rumination times (minutes), number of regurgitated cuds and number of chewing cycles per cud in 24 healthy cows (group A) and 76 cows with various postpartum diseases (group B).

	Eating times (minutes)		Rumination times (minutes)		Number of regurgitated cuts		Number of chewing cycles per cud	
Time point	A	B	A	B	A	B	A	B
Prep 14–10	387 ± 86	362 ± 97^{a}	461 ± 67**	464 ± 66**	554 ± 74**	551 ± 79**	62 ± 8	60 ± 9
Prep 9–5	358 ± 80	349 ± 102	458 ± 70**	458 ± 70**	561 ± 87**	544 ± 86**	62 ± 9	61 ± 8
Prep 4–1	352 ± 82	331 ± 108	442 ± 68**	438 ± 77**	551 ± 89**	526 ± 92**^{a}	61 ± 9	60 ± 8
Parturition	356 ± 120	328 ± 129	319 ± 78	292 ± 108	419 ± 115	369 ± 142	59 ± 11	57 ± 10
Postp 1	369 ± 88	348 ± 123	416 ± 67**	385 ± 97**	516 ± 89**	456 ± 115**^{a}	62 ± 10	61 ± 9
Postp 2–5	382 ± 88	350 ± 109^{aa}	489 ± 57**	464 ± 96**^{a}	572 ± 81**	532 ± 111**^{aa}	65 ± 9	62 ± 8**^{aa}
Postp 6–10	403 ± 73	370 ± 104^{aa}	481 ± 59**	490 ± 67**	574 ± 73**	567 ± 77**	63 ± 9	61 ± 8*^{a}
Postp 11–15	413 ± 74	386 ± 101**^{aa}	484 ± 64**	490 ± 61**	590 ± 72**	571 ± 74**^{a}	61 ± 8	61 ± 8
Postp 16–20	428 ± 78**	395 ± 99**^{aa}	483 ± 61**	494 ± 57**	589 ± 80**	580 ± 74**	61 ± 8	61 ± 7
Postp 21–25	429 ± 79**	403 ± 103**^{a}	480 ± 54**	484 ± 66**	594 ± 76**	579 ± 79**	61 ± 8	60 ± 7
Postp 26–30	439 ± 68**	404 ± 103**^{aa}	467 ± 59**	476 ± 80**	586 ± 94**	570 ± 95**	60 ± 9	59 ± 9

Prep Prepartum; Postp Postpartum
^{a}, ^{aa} within rows, times differ from group A; $^{a}P < 0.05$; $^{aa}P < 0.01$
*, ** within columns, times differ from parturition; *P < 0.05; **P < 0.01

Results

The findings of groups A and B and subgroups B1 to B5 are reported in detail in the dissertation by Buchli (2017).

Duration of eating

In groups A and B, the mean duration of eating exceeded the reference interval established for 300 healthy cows (Braun et al., 2015) throughout the study period (Fig. 1, Tab. 1). In healthy cows, the duration of eating ranged from 352 to 413 minutes before until 15 days after parturition. From day 16 to day 30 postpartum, duration of eating ranged from 428 to 439 minutes, which was significantly longer than on the day of parturition (356 minutes, $P < 0.01$). Eating profiles were similar in both groups A and B but eating time was significantly shorter in group B than in group

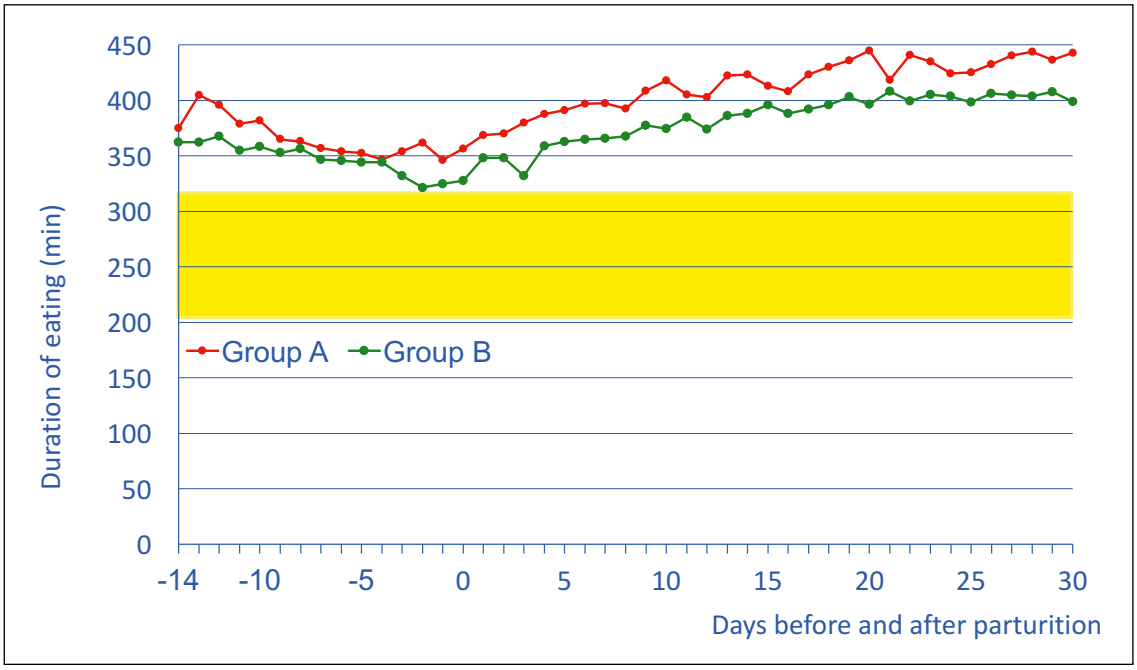

Figure 1: Daily eating time in the cows of group A (healthy cows, n = 24) and B (ill cows, n = 76) from 14 days before to 30 days after parturition. The yellow bar represents the reference interval from 211 to 319 minutes established in 300 healthy cows (Braun et al., 2015).

A 14 to 10 days prepartum and 2 to 30 days postpartum.

Compared with healthy cows, cows with parturient paresis had significantly shorter eating times 14 to 10 days prepartum and on most days postpartum. Cows with metritis had a shorter duration of eating than healthy cows before and after calving. With the exception of 2 time points, healthy and ketotic cows did not differ significantly with respect to eating time. Lame cows had shorter eating times than healthy cows.

Duration of rumination

In groups A and B, the duration of rumination was within the reference interval established for 300 healthy cows (Braun et al., 2015) except for the day of calving (Fig. 2, Tab. 1). Mean duration of rumination in healthy cows was 461 minutes on days 14 to 10 prepartum and 319 minutes on the day of calving, which reflected a significant decrease ($P < 0.01$). There was a significant ($P < 0.01$) increase to 416 minutes by day 1 postpartum, and from day 2 to day 30, the duration ranged from 467 to 489 minutes. Rumination times of cows in group B were similar to those of healthy cows except on days 2 to 5 when they were significantly shorter.

Cows with retained placenta had significantly shorter rumination times than healthy cows on days 2 to 5 postpartum. Lame cows had significantly longer rumination times than healthy cows on nearly all days.

Number of regurgitated cuds

Except for the day of calving and the following day, the numbers of regurgitated cuds in cows of groups A and B were within the reference interval established for 300 healthy cows (Braun et al., 2015; Fig. 3, Tab. 1). Healthy cows had 554 cuds on days 14 to 10 prepartum and 419 cuds on the day of calving, which reflected a significant decrease ($P < 0.01$). There was a significant increase to 516 cuds by day 1 postpartum ($P < 0.01$). From day 2 to day 30, the number of cuds ranged from 572 to 594.

The profile of the number of cuds in cows of group B was similar to that of healthy cows but the number was significantly lower from day 4 to day 1 prepartum and on the first 5 days postpartum.

Cows with retained placenta had significantly fewer cuds than healthy cows on days 2 to 25 postpartum, and lame cows had significantly fewer cuds than healthy cows on days 2 to 5 postpartum.

Chewing cycles per regurgitated cud

In groups A and B, the numbers of chewing cycles per cud were within the reference interval established in 300 healthy cows (Braun et al., 2015; Fig. 4, Tab. 1). The number did not change significantly during the study period in healthy cows and ranged from 59 to 65. Cows of group B had significantly fewer chewing cycles on days 2 to 10 postpartum than on the day of calving ($P < 0.01$).

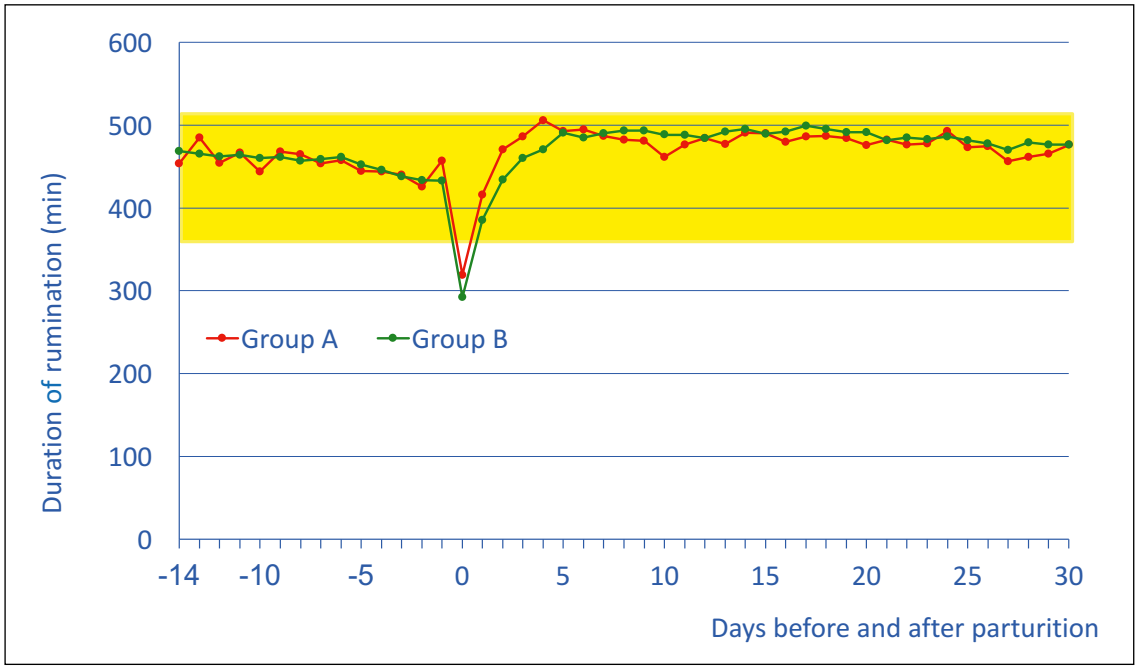

Figure 2: Daily rumination time in the cows of group A (healthy cows, n = 24) and B (ill cows, n = 76) from 14 days before to 30 days after parturition.The yellow bar represents the reference interval from 370 to 511 minutes established in 300 healthy cows (Braun et al., 2015).

Cows with periparturient paresis had significantly fewer chewing cycles per cud than healthy cows on days 2 to 5 postpartum ($P < 0.01$). Cows with primary ketosis had fewer chewing cycles than healthy cows on days 2 to 5 and 21 to 25 postpartum. Lame cows had fewer chewing cycles than healthy cows on days 9 to 1 prepartum and more on days 11 to 30.

Discussion

In the healthy cows of the present study, the duration of eating decreased continuously before calving and increased in the first 10 days postpartum in agreement with the findings of other studies (Journet and Remond, 1976; Urton et al., 2005; Tschoner, 2013; Braun et al., 2014), but was longer than other recordings during the periparturient period (Huzzey et al., 2005; Urton et al., 2005; Huzzey et al., 2007; Braun et al., 2014). The eating times observed in the present study were similar to those reported for cows in later stages of lactation (Beauchemin, 1991; Tafaj et al., 1999).

The ill cows in group B had shorter eating times than healthy cows, which was in agreement with earlier reports of depressed feed intake both before and after calving in cows with postpartum disorders (Zamet et al., 1979a; Weingarten, 1996). These authors surmised that the increased disease incidence was the result of the reduction in feed intake prepartum and that the disorder itself led to further appetite depression. The shortest duration of eating in ill cows was seen on day 3 postpartum. The reduced eating times of ill cows continued until the end of the study (30 days postpartum), but this is not surprising because 43 of the 76 cows had failed to recover completely by that time. Compared with healthy cows, cows with periparturient paresis had the shortest duration of eating on the day of calving. Other authors (Jørgensen et al., 1998; Goff, 2008) reported reduced eating and rumination activities in cows with mild hypocalcaemia. In cows that eventually developed hypocalcaemia, feed consumption was reduced by 18% as early as 3 weeks prepartum, by 44% on the day of calving and by 28% postpartum compared with healthy cows (Zamet et al., 1979a). The eating time of cows with metritis was shortest on days 4 to 1 prepartum and 2 to 5 postpartum and compared with healthy cows remained low until the end of the study period. In these cows, reduction in feed consumption preceded the diagnosis of metritis, which was made on days 5 to 10 postpartum. It is possible that a negative energy balance caused by reduction in feed intake led to immunosuppression and thus infection (Ingvartsen and Andersen, 2000; Sordillo and Raphael, 2013). The protracted reduction in eating time may have been linked to pain caused by uterine inflammation (Stojkov et al., 2015). It was shown that cows with retained placenta alone and cows with retained placenta followed by metritis had a

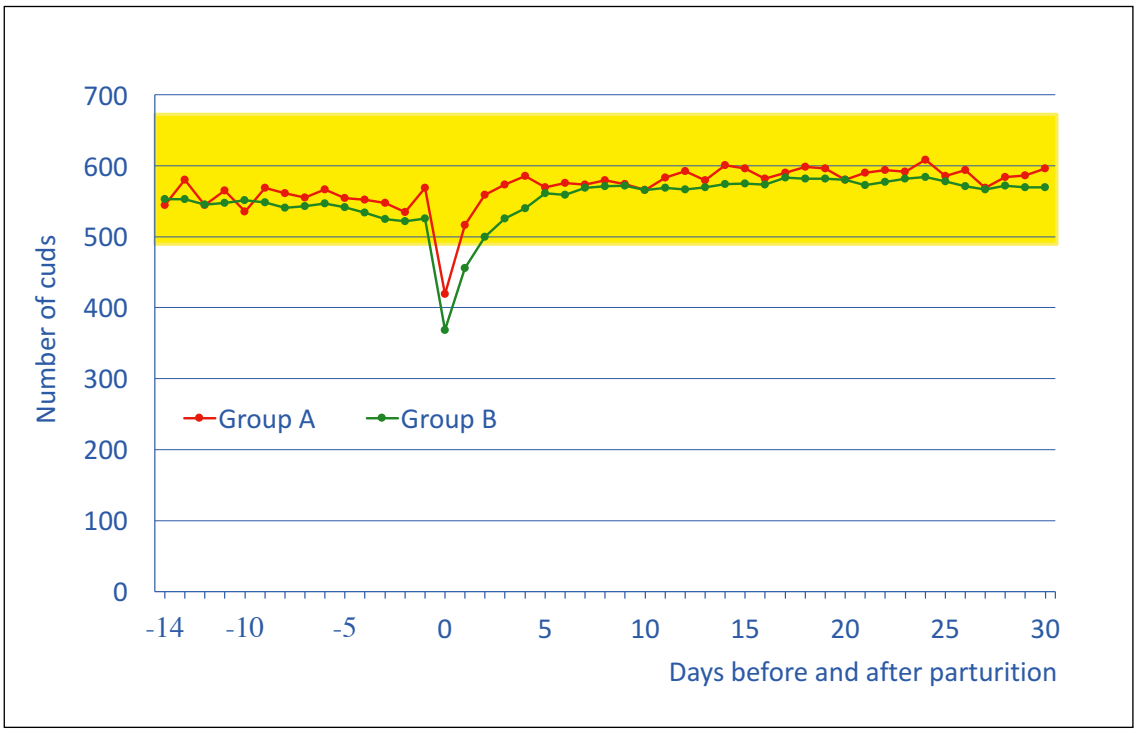

Figure 3: Number of regurgitated cuds per day in the cows of group A (healthy cows, n = 24) and B (ill cows, n = 76) from 14 days before to 30 days after parturition. The yellow bar represents the reference interval from 484 to 672 cuds per day established in 300 healthy cows (Braun et al., 2015).

reduction in feed intake by 18 and 22 to 55%, respectively (Zamet et al., 1979b; Laven and Peters, 1996). In addition, cows with metritis and a fever had shorter eating times than healthy cows (Urton et al., 2005) and severe metritis was preceded by a reduction in feed consumption as early as before calving (Huzzey et al., 2007). Of note, duration of eating did not differ between cows with primary ketosis and healthy cows, which was counterintuitive considering that a reduction in feed consumption and eating time is commonly seen in cows with subclinical and clinical ketosis (Zamet et al., 1979b; Smith and Risco, 2005; González et al., 2008; Goldhawk et al., 2009). Lame cows had the shortest eating times, which may have been attributable to increased periods of recumbency (Collard et al., 2000; Galindo and Broom, 2002; González et al., 2008) and to being bullied at the feed bunk by higher ranking non-lame cows (Friend and Polan, 1974; Grant and Albright, 1995). The pronounced reduction in eating time before calving was attributable to 3 cows that were lame at that time.

Duration of rumination in healthy cows did not differ before and after calving and the only significant reduction occurred on the day of calving. Rumination time increased as early as one day later and fluctuated within a narrow range from day 2 to day 30 in agreement with the findings of other studies (Journet and Remond, 1976; Soriani et al., 2012; Braun et al., 2014; Calamari et al., 2014; Pahl et al., 2014; Hoy, 2015; Clark et al., 2015). The nadir on the day of calving has been attributed to hormonal changes (Pahl et al., 2015), and it is possible that parturition itself reduces rumination activity (Grunert, 1993). In one study, rumination was reduced by 70% on the day of calving (Calamari et al., 2014), and in another, the postpartum rebound was slow (Pahl et al., 2014). The postpartum increase in rumination time is also related to an increase in feed consumption. The rumination time was significantly shorter in ill cows than in healthy cows only on days 2 to 5 postpartum. There were only a few significant differences in rumination variables between cows with specific diseases and healthy cows, which was in contrast to the findings of several studies that observed large differences in rumination between healthy cows and cows with subclinical or clinical diseases or even cows before they became ill (Soriani et al., 2012; Calamari et al., 2014; Hoy, 2015; Liboreiro et al., 2015). Cows that became ill with periparturient paresis had a reduced rumination time as early as two days prepartum and had the lowest duration of rumination of all cows on the day of parturition. Cows with subclinical hypocalcaemia also were found to have shorter rumination times than healthy cows on the day of calving (Liboreiro et al., 2015). Cows with retained placenta had shorter rumination times than healthy cows, which was attributable to a slower rebound 2 to 5 days after calving as a result of the disease. The number of regurgitated cuds in cows with

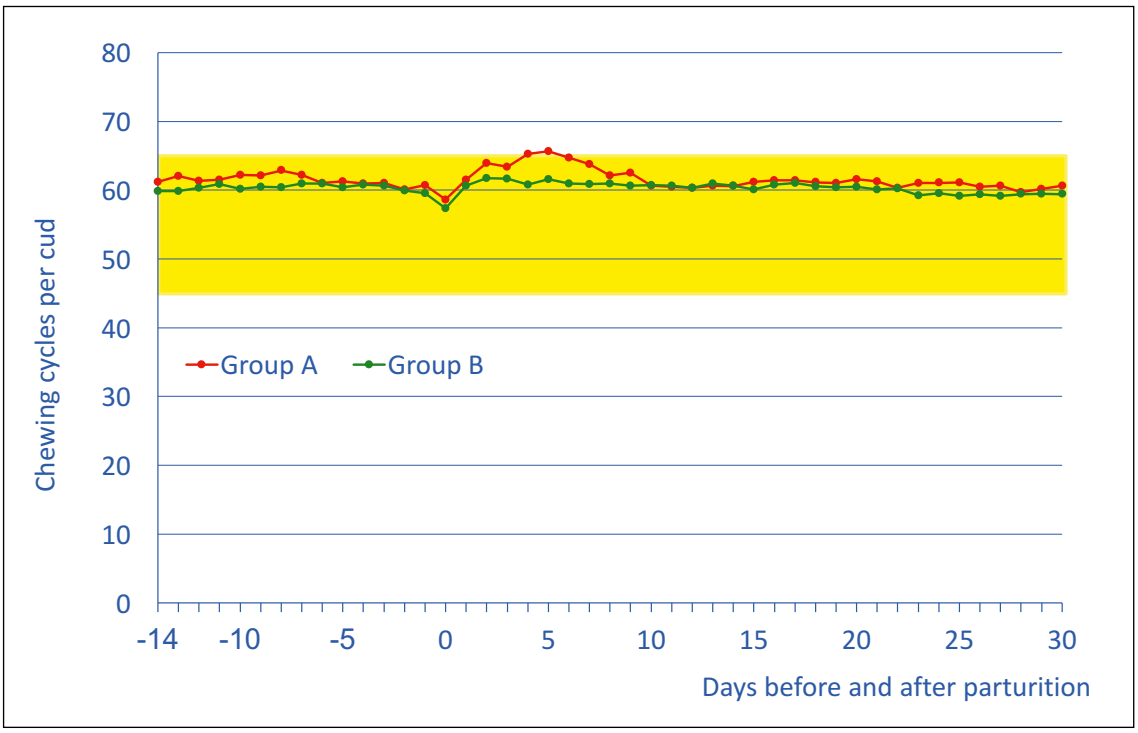

Figure 4: Number of chewing cycles per regurgitated cud in the cows of group A (healthy cows, n = 24) and B (ill cows, n = 76) from 14 days before to 30 days after parturition. The yellow bar represents the reference interval from 45 to 65 cycles established in 300 healthy cows (Braun et al., 2015).

retained placenta remained lower than in healthy cows until day 25 postpartum, which was in agreement with other reports (Liboreiro et al., 2015; Stangaferro et al., 2015). In the present study, cows with metritis had rumination activities similar to those in healthy cows. This is in contrast to the results of other reports, in which shorter rumination times were described in cows with metritis compared with healthy cows (Liboreiro et al., 2015; Stangaferro et al., 2015). Duration of rumination did not differ between cows with primary ketosis and healthy cows, whereas other authors reported reduced rumination activities in cows with subclinical ketosis and cows that subsequently developed clinical ketosis (Steensels et al., 2012; Liboreiro et al., 2015). Cows that developed ketosis had reduced rumination activities 2 to 5 days before the disease was diagnosed (Steensels et al., 2012). Lame cows had longer rumination times than healthy cows both before and after calving. Our findings were similar to those of other reports of longer rumination times in lame cows (Hassall et al., 1993; Van Hertem et al., 2013) and could be explained by increased rumination activities observed in lying cows (Schirmann et al., 2012).

Rumination time, number of regurgitated cuds and number of chewing cycles per cud recorded in the present study were within the reference intervals established in 300 healthy cows (Braun et al., 2015), but mean eating times of healthy as well as ill cows were not. We cannot explain this discrepancy as the cows had similar milk production and were kept under similar management conditions, and the recording techniques were identical.

Conclusion

The peripartum period is a time when cows are at risk of developing a number of diseases; 76 of 100 cows in the present study had a periparturient disorder. Eating and rumination activities during this period changed in healthy as well as in ill cows. Even though these changes were more pronounced and often longer-lasting in ill cows, absolute values are useful for the early recognition of periparturient disorders only when changes are severe. It is therefore recommended that eating and rumination activities be monitored individually and continuously and that deviations from baseline be primarily used for the recognition of impending or already manifest diseases.

Alimentation et rumination chez 100 vaches saines ou souffrant d'affections péri-partum du 14ème jour ante-partum jusqu'au 30ème jour post-partum

Dans le présent travail, on examine les paramètres de l'alimentation et de la rumination chez 100 vaches initialement en bonne santé depuis le 14ème jour ante-partum jusqu'au 30ème jour post-partum. Les enregistrements ont été effectués au moyen d'un détecteur de pression fixé dans la muserolle d'un licol qui enregistrait les mouvements de mastication. On a exploité les données relatives à la durée de l'alimentation et de la rumination, au nombre de boli de rumination et au nombre de mouvement de mastication par bolus de rumination. Après la période de mesures, on a réparti les vaches en deux groupes sur la base de leur état de santé, le groupe «saines» (n = 24) et le groupe «malades» (n = 76). Les vaches malades ont été réparties en divers sous-groupes: parésie puerpérale (n = 12), rétention placentaire (n = 13), métrite (n = 17), cétose primaire (n = 19) et boiterie (n = 6). Chez les 24 vaches saines, les paramètres d'alimentation et de rumination étaient au point le plus bas le jour de la mise-bas. On constatait une réduction continuelle de la durée de l'alimentation durant les 14 jours précédant le vêlage puis une augmentation

L'alimentazione e la ruminazione in 100 mucche sane e malate in peripar-to durante 14 giorni ante partum e fino a 30 giorni post partum

In questo studio i parametri dell'alimentazione e della ruminazione sono stati esaminati in 100 mucche inizialmente sane da 14 giorni ante partum fino a 30 post partum. Le registrazioni sono state effettuate con un sensore sensibile alla pressione che è stato integrato nella banda sul naso del capestro e che rileva i movimenti di masticazione. Sono stati valutati la durata dell'alimentazione, della masticazione, il numero di boli nella ruminazione, il numero di masticazioni per bolo. Alla fine dell'esame, le mucche sono state suddivise in due gruppi principali: mucche sane (n = 24) e malate (n = 76) sulla base della loro salute durante il periodo dell'esame. Le mucche malate sono state suddivise in ulteriori sotto-gruppi: paresi puerperale (n = 12), comportamento dopo il parto (n = 13), metrite (n = 17), chetosi primaria (n = 19) e zoppia (n = 6). Nelle 24 mucche sane i parametri della masticazione e della ruminazione erano i più bassi. La durata dell'alimentazione era di 14 giorni fino al momento del parto con una diminuzione continua e quindi poi un costante incremento. Al contrario la durata della ruminazione prima e dopo il parto risultava simile e solo il giorno del parto dimi-

constante. Par contre la durée de la rumination restait constante avant et après la mise-bas et n'était significativement abaissée que le jour du vêlage. Les 76 vaches malades montraient ante et post partum une durée d'alimentation significativement plus courte que les vaches saines. La durée de rumination était raccourcie du 2ème au 4ème jour post-partum chez les vaches malades par rapport aux vaches saines; on ne constatait sinon pas de différence en ce qui concerne les paramètres de rumination. Puisque la durée d'alimentation est différente déjà avant la mise-bas entre les vaches saines et les vaches malades, il faut étudier si et comment ce paramètre pourrait être utilisé pour une reconnaissance précoce des animaux à risque durant la période péri-partum.

nuiva significativamente. Le 76 mucche malate hanno mostrato ante e post partum una durata di masticazione significativamente inferiore che le mucche sane. La durata della ruminazione era inferiore nei primi 2–4 giorni post partum nelle mucche malate per rapporto alle mucche sane. Altrimenti per quanto riguarda i parametri di ruminazione non si è registrata nessuna differenza. Già da prima della nascita, la durata della masticazione nelle mucche sane e malate si differenzia, perciò bisognerebbe chiarire se e come questi parametri sono adatti al precoce riconoscimento del rischio per gli animali nel periodo del periparto.

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