CHANGES IN THE MILK YIELD AND PH AND TEMPERATURE OF RETICULORUMEN AFTER OMENTOPEXY

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Abstract. The objective is to identify changes in the milk yield and pH and temperature of reticulorumen content after omentopexy.

The research was performed in a dairy farm with 550 cows on December 2014–January 2015. The sample consisted of 10 cows. The left-sided displacement of the abomasums was diagnosed in 5 of them, which was treated by lateral omentopexy according to Dirksen; the rest 5 were used for control. Additional treatment was not applied. A special bolus for measuring pH and temperature was administered to the reticulorumen of healthy cows and cows after the operation. The milk yield was registered with the help of herd management program Westfalia DP C21. Rectal temperature of all cows was measured. All data were recorded once a week for four weeks.

Statistically reliable difference in the milk yield ($p< 0.05$) between the research groups was observed during the entire research. The major difference was recorded on Week 1 after the treatment (29.18 kg/d); in Week 4, the difference was 13.97 kg/d. During the entire research, the reticulorumen pH of the Test group was lower than that of the Control group. Statistically reliable difference between the groups was identified on Week 1 ($p< 0.05$). During the period mentioned, the pH of the reticulorumen content of the Test group was lower by 0.42 than that of the Control group. In Week 3, the difference increased up to 0.84. In Weeks 1, 2, and 3, statistically reliable ($p< 0.05$) higher temperature was observed in the Test group. Major differences of temperature, 1.81 °C, were recorded in Week 1. In Week 4, the temperature of the reticulorumen in the Test group became equal to that of the Control group.

The first four weeks after omentopexy treatment showed the following results: statistically reliable difference in the milk yield remained most obvious in Week 1 after the treatment; cows with left-sided displacement of abomasums were exposed to greater risk of acidosis; they indicated lower pH of reticulorumen content; the first two weeks after omentopexy, reticulorumen content has increased temperature, especially obvious in Week 1.

Keywords: displacement of the abomasum, reticulorumen, omentopexy, milk yield

Introduction. Displacement of the abomasum (DA) is one of the most common diseases recorded in dairy cattle specially after calving (Stengärde 2010, Dezfouli et al., 2013). The left displacement of the abomasum (LDA) is a common disease in periparturient dairy cows (Antanaitis et al., 2014). The left DA is much more common (85–96 % of DA) than the right DA which accounts for 4–15 % of cases (Nasr et al., 2014). Abomasum displacement cause economic losses in dairy farms as a result of treatment prices, premature culling and production loss (Dezfouli et al., 2013). Moreover, it is more common in intensive production farms (Stariè et al., 2010). Holstein cows with LDA were reported to cause altered glucose metabolism with ketonuria because of decreased feed intake, postpartum, retained placenta or metritis (LeBlanc et al., 2005).

Cattle with LDA showed reduction in appetite, selective appetite (eagerness to eat hay but reluctance to eat grains), pasty feces, characteristic highpitched ping in percussion over the left middle to upper third of the abdomen between ribs 9 and 11, and a splashing sound with bell-like echo induced by ballottement (Mokhber Dezfouli et al., 2013). Surgical correction of the left displaced abomasum (LDA) is common in lactating dairy cattle. The left abomasal displacement (LDA) occurs more frequently than the right displacement (Doll et al., 2009). Cattle diagnosed with LDA corrected via right flank omentopexy or left flank abomasopexy were significantly more likely to return to normal milk production as compared to those corrected via right flank omentoabomasopexy (Rebecca et al. 2014).

Dysfunctional reticulorumen results in impaired digestion and increased susceptibility to various digestive and metabolic diseases (Kirbas et al., 2014). Subacute ruminal acidosis is one of the most important metabolic disorders, traditionally characterized by low reticulorumen pH, which might be induced by an increase in the dietary proportion of grains as well as by a reduction of structural fibre (Colman et al., 2013). Ruminal acidosis is an important nutritional disorder in ruminants, which results from feeding highly fermentable feeds to increase productivity (Khafipour et al., 2009). Sub-acute ruminal acidosis (SARA) has become an increasing problem in well-managed, high yielding dairy herds and the monitoring of groups of cows for signs of the condition is now crucial (Jörg 2008). During subacute ruminal acidosis, reticulorumen pH is depressed for several hours per day due to accumulation of volatile fatty acids and insufficient reticulorumen buffering (Plaizier et al., 2008).

The objective is to identify the changes in the milk yield and pH and temperature of reticulorumen content after omentopexy.

Materials and methods. The research was performed in a dairy farm with 550 cows on December 2014–January 2015. The sample consisted of 10 cows. Left-sided displacement of the abomasums was diagnosed in 5 of them, which was treated by omentopexy according to

Dirksen; the rest 5 were used for control. Additional treatment was not applied. All the cows researched were kept in a uniform environment and received a uniform ration suitable for this stage of lactation (Table 1). The average DIM (day in milk) were 25 (±5), average of age were 2.2 (±0.2) lactation and milk yield of was 30 (±3) kg/d.

Table 1. Composition of rations

Ration	Quantity	Ration	Quantity
Green mass	29.56 kg	Ca	127.5 g
Dry material	17.93 kg	P	79.4 g
NEL	108.4 MJ	Mg	51.5 g
Crude protein	2,560 g	Na	38.7 g
Crude fibre	3,711 g	K	274.1

The pH and temperature of the contents of their reticulorumens were measured using specific smaXtec boluses manufactured for animal care. SmaXtec animal care technology® enables the continuous real-time display of data such as ruminal pH and temperature. According to the directions of the manufacturer, the boluses were inserted into the reticulorumens of the cows researched with the help of a specific tool. The data was measured with the help of specific antennas (smaXtec animal care technology®). For monitoring the reticuloruminal pH, an indwelling and wireless data transmitting system (smaXtec animal care GmbH, Graz, Austria) was used (Gasteiner et al., 2009). The data (pH, temperature) was collected by means of an analogue to digital converter (A/D converter) and stored in an external memory chip. Due to its dimensions (length: 12cm; width: 3.5cm; weight: 210g), this indwelling system can be orally administered to an adult cow, and it is shock-proof and resistant to reticulorumen fluid. Calibration of the pH-probes was performed using pH 4 and pH 7 buffer solutions at the beginning of the experiment.

A special bolus for measuring pH and temperature was administered to the reticulorumen of healthy cows and cows after the operation (smaXtec animal care sales GMBH, Graz, Austria).

The milk yield was registered with the help of herd management program DP C21 (Westfalia Surge Inc.,GEA). The daily milk yield was the sum of three milkings. Rectal temperatures was measured in all cows using a digital thermometer and in accordance with the clinical trial plan. All data were recorded once a week for four weeks.

The research was conducted following the provisions of the Law of the Republic of Lithuania No. 11-2271 on Protection, Keeping and Use of Animals, dated 03/10/2012 (*Valstybės žinios* (official gazette) No. 122-6126 dated 20/10/2012) and of the by-laws, and Education and training purposes of animals used in storage, maintenance and conditions of use No. B1-866, dated 31/10/2012 *(Valstybės žinios* (official gazette) No. 130-6595 dated 10/11/2012).

The data obtained during the investigation was processed using a statistical software package SPSS (SPSS for Windows 15.0, SPSS Inc., Chicago, IL, USA, 2006). The data were considered to be statistically reliable at $p<0.05$.

Results and discussion

Milk yield. Statistically reliable difference in the milk yield ($p<0.05$) between the research groups was observed during the entire research. The major difference was recorded in Week 1 after the treatment (29.18 kg/d); in Week 4, the difference was 13.97 kg/d (Fig. 1). Cows that developed displacement of the abomasum had lower feed intake, lower milk production was reported Antanaitis et al., (2009). In the case of left DA, milk production decreased on average by 3.7 kg (16.6 %) and in the case of right DA by 9.2 kg (43.3 %) compared to the controls respectively. After clinical symptoms of DA appeared, milk production reduced on average by 14.8 kg (60.5 %) (Antanaitis et al., 2009).

Milk yield, from experiments in which subacute ruminal acidosis (SARA) was induced in lactating dairy cows, dropped from 35.2 kg/d during baseline to 31.7 k/d during the challenge period and did not return to baseline level during the recovery period (31.3 kg/d) (Krause and Oetzel 2005).

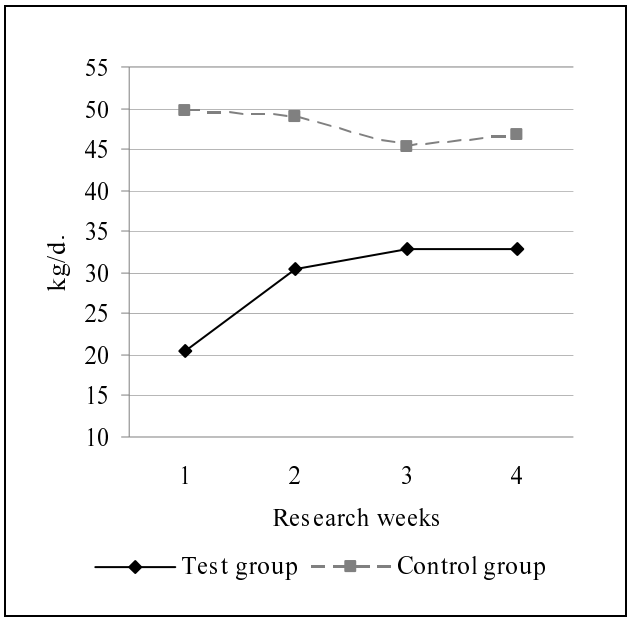

Fig. 1. **Changes in milk yield during the research**

Reticulorumen pH. During the entire research, reticulorumen pH of the Test group was lower than that of

the Control group (Fig. 2). Statistically reliable difference between the groups was identified in Week 1 ($p<0.05$). In the period mentioned, the pH of the reticulorumen content of the Test group was lower by 0.42 than that of the Control group. In Week 3, the difference increased up to 0.84. Low reticulorumen pH can cause reticulorumenitis, metabolic acidosis, lameness, hepatic abscesses formation, pneumonia, and even death (Bramley et al., 2008). The condition in which pH is depressed for prolonged periods each day is defined as subacute ruminal acidosis (SARA). Subclinical reticulorumen acidosis is defined as a condition where reticulorumen fluid pH is below 6.0 while acute reticulorumen acidosis is when reticulorumen pH is below 5.5 associated with reticulorumen motility that is weak or ceased (Ingvartsen et al., 2006). Subacute ruminal acidosis is a metabolic disorder affecting reticulorumen fermentation and functionality, animal health and productivity of dairy cows with a considerable prevalence in the European herds (Kleen et al., 2009).

Subacute or subclinical ruminal acidosis (SARA) is considered to be one of the major threats to the welfare of lactating dairy cows and may affect up to 20 % of cattle in early to mid lactation (Rushen et al., 2008). This is an ongoing and costly digestive disorder of dairy cows (Plaizier et al., 2008, Marchesini al., 2013). For optimum fermentation of the diet and fibre digestion, ruminal pH should be between 6.0 and 6.4 because the cellulolytic bacteria, which allow the digestion of fibre, are inhibited when pH is less than 6.0 (AlZahal et al., 2009). AlZahal et al. (2011), continuously monitored ruminal pH and temperature in dairy cows, and determined that low ruminal pH is associated with an increased ruminal temperature.

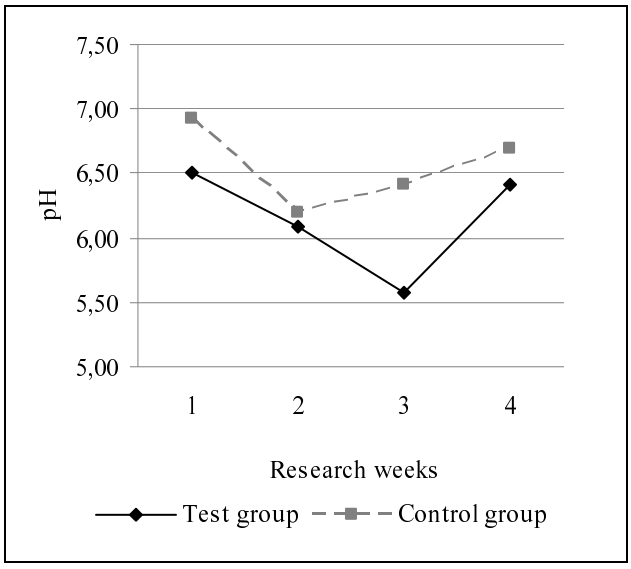

Fig. 2. **Changes in the pH of reticulorumen content during the research**

Reticulorumen temperature. In Weeks 1, 2, and 3, statistically reliable ($p<0.05$) higher temperature was observed in the Test group. Major difference of temperature, 1.81 °C, was recorded in Week 1. In Week 4, the temperature of reticulorumen in the Test group became equal to that of the Control group (Fig. 3). Ruminal temperature exceeds rectal temperature presumably due to accelerated microbial fermentation. Moreover, there is a strong relationship between ruminal and rectal temperature, and between the reticular temperature and intake water temperature or rectal temperature in healthy cows (Commun 2011). Reticulorumen temperature measurement may aid in the detection of SARA since a close inverse correlation with reticulorumen pH was reported AlZahal et al. (2008).

A close relationship between reticulorumen pH and temperature, as indicated by AlZahal et al. (2011) would be expected to be inverse and to arise especially during intensive postprandial fermentation reflecting both decreasing reticulorumen pH but increasing reticulorumen temperature.

Forestomach temperature was found to be strongly correlated with rectal temperature (Kimura et al., 2012), and may be a useful diagnostic parameter for the detection of estrus, heat stress or infectious diseases in dairy cows (AlZahal at al., 2009). In our study, we found a positive Correlation between Rectal temperature and Reticulorumen content temperature in the test group were $r=0.325$ ($p<0.05$), and in the control group $r=0.250$ ($p<0.05$). (Fig 4 and 5).

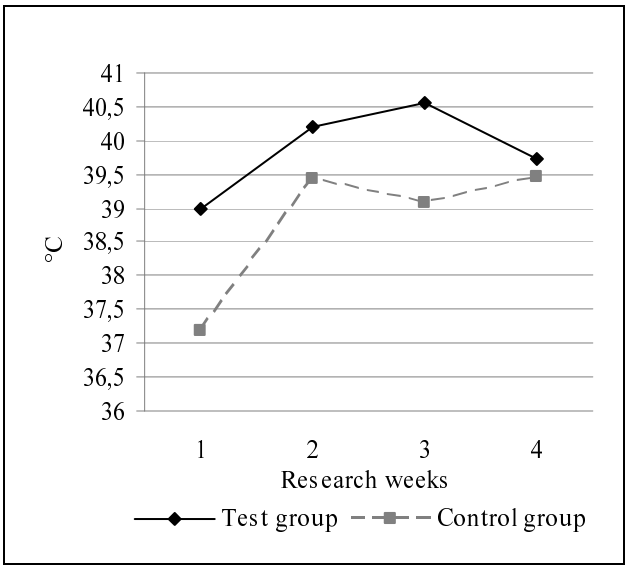

Fig. 3. **Changes in temperature of reticulorumen content during the research**

Conclusion. After omentopexy treatment, the first four weeks showed the following results:

1. Statistically reliable difference in the milk yield remained the most obvious in Week 1 after the treatment.
2. Cows with left-sided displacement of abomasums were exposed to greater risk of acidosis; they indicated lower pH of reticulorumen content.
3. The first two weeks after omentopexy, reticulorumen content had higher temperature, especially obvious in Week 1.

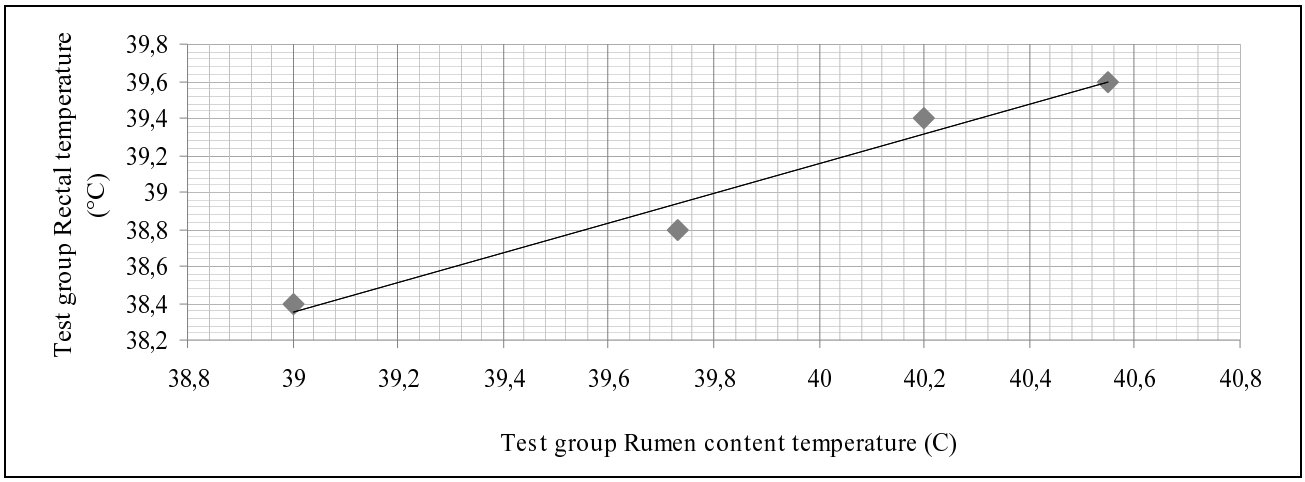

Fig. 4. **Correlation between Rectal temperature and reticulorumen content temperature in the Test group**

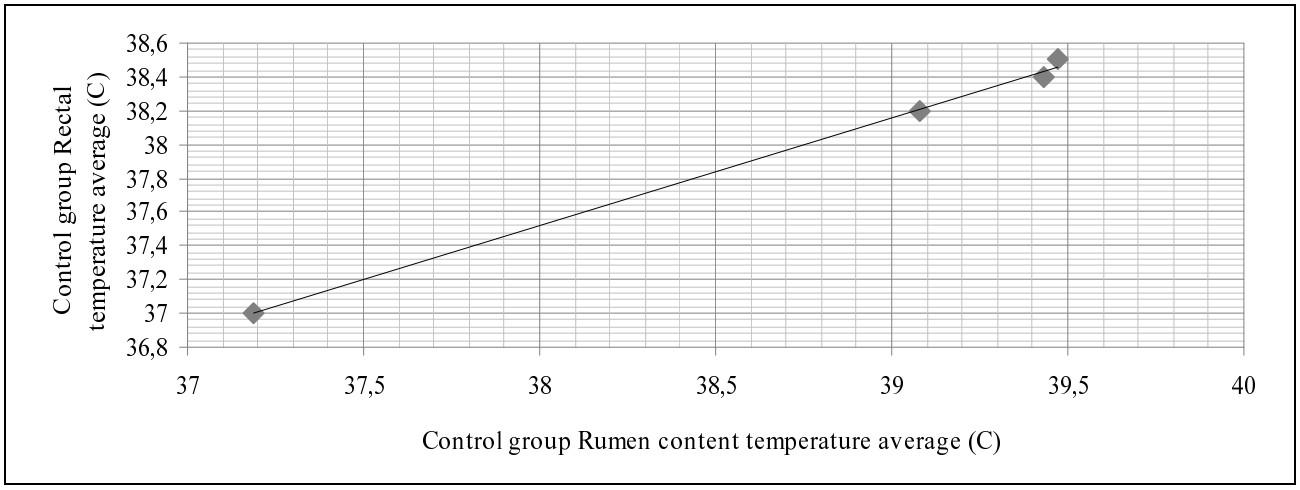

Fig. 5. **Correlation between the rectal temperature and reticulorumen content temperature in the Control group**

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