IMPACT OF GLUCOROTICOIDS AND NONSTEROIDICALANTIIFLAMATORY DRUGS ON MILK YIELD, COW ACTIVITY, GLUCOSE AND BETA-HYDROXYBUTYRATE CONCENTRATION IN BLOOD AFTER OMENTOPEXY

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Summary. The aim of this study was to determinate impact of glucoroticoids (SAID) and nonsteroidical antiiflamatory (NSAID) drugs on milk yield, cow activity, glucose and beta-hydroxybutyrate concentration in blood after omentopexy. For this research, 62 multiparous cows were selected. The left displaced abomasum was diagnosed during the clinical trial. All the cows with left displaced abomasum had surgical treatment according to a right paralumbar fossa omentopexy. According to the additional treatment plan, the cows were divided into three groups: The first group (SAID) of cows were injected with glucocorticoids after surgery DEXAJECT™, (2 mg per mL, Bimeda-MTC Animal Health Inc., Cambridge, ON Canada), with one 20 mg dose, intravenously), n=21. The second group (NSAID1) of cows were injected NSAID with Rimadyl Cattle (carprofen 50 mg/ml) after surgery. This was an intravenous injection at a dosage of 1.4 mg carprofen per kg body weight (1 ml/35 kg), n=21. The third group (NSAID2) of cows were injected NSAID with a single intravenous injection of Loxicom 20mg/ml after surgery at a dosage of 0.5 mg meloxicam/kg body weight (i.e., 2.5 ml/100kg body weight), n=20. For the purpose of biochemical testing, blood samples were collected from v. coccigea right before the surgery (Day 0), and three days (Day 7), fourteen days (Day 14), and twenty-one days (Day 21) after the surgery. Accordig results, SAID injection after an omentopexy increases the glucose level, decreases the beta-hydroxybutyrate, evel in blood, and the milk yield NSAID injection has a positive effect on the milk yield and cow activity. According this conclusion after omentopexy is better to use NSAID.

Keywords: cow, left displaced abomasum, omentopexy, beta-hydroxybutyrate

Introduction. Surgical intervention for abomasal displacement is the most common surgery that occurs in adult dairy cows (Hewson et al., 2007). Given that the incidence risk of left displaced abomasum (LDA) has been reported to be between 3 and 7% of calvings (Chapinal et al., 2011). In a survey of Canadian veterinarians, the mean pain score for a displaced abomasum omentopexy was 7.2 out of 10 (Hewson et al., 2007). Respondents to a New Zealand survey gave a median pain score of 9 out of 10 for LDA surgery (Laven et al., 2009), and a British survey reported that a pain assessment for a laparotomy in cattle of 3 to 7 out of 10 (Watts and Clarke, 2000). Essentially all cows that underwent an omentopexy for displaced abomasum received analgesia, and the drugs most commonly administered were lidocaine and xylazine (Hewson et al. 2007). Watts and Clarke (2000) reported that 57% of cases involved cows receiving a nonsteroidal antiinflammatory drug (NSAID; e.g., ketoprofen or flunixin meglumine) following laparotomy surgery. Few analgesics exist that are approved for use in lactating dairy cows in the United States and Canada, and many that are approved, or those for which prescribing data are available, require milk and meat withdrawal periods. Although some veterinary practitioners may include the use of NSAID as part of postoperative care, use of analgesics is limited in dairy cattle production (Hewson et al., 2007; Newman et al., 2008; Croney and Anthony, 2011). Minimizing pain in companion animals has been an integral part veterinary practice (Hansen, 2003), and has long been recognized as a key component when evaluating animal welfare. As a consequence of their stoic nature, the visible and more easily detectable clinical signs, such as lameness, may only occur with severe pain caused by the advanced progression of disease (O'Callaghan, 2002). According Mainau et al., (2014), meloxicam-treated heifers showed greater step activity than heifers. According to the study by Edwards and Tozer (2004), heifers walked longer distances than multiparous cows during early lactation. These authors demonstrated that healthy cows were more active (number of steps taken per hour) than cows with metabolic or digestive problems. Using continuous video observation, Newby et al. (2013) demonstrated that meloxicam administered after calving in cows could alleviate some postcalving pain because treated cows increased the number of feeding visits and total time spent.

Glucocorticoids decrease blood ketone concentrations in cows with clinical ketosis, and increase blood glucose concentrations in cows with clinical ketosis and in healthy cows (Coffer et al., 2006). Glucocorticoids have been shown to reduce milk production in healthy dairy cows in most (Coffer et al., 2006) but not all (Jorritsma et al., 2004) studies. Hartmann and Kronfeld (1973) demonstrated reduced mammary uptake of glucose following administration of dexamethasone. A reduced glucose drain for lactose production by the mammary gland would provide a plausible explanation for the rise in blood glucose concentrations. However, in cows with clinical ketosis, a reduction in milk production was not observed after treatment with glucocorticoids (Philipp et al., 1991). According Geisthauser et al., (1997), ketosis is a significant risk factor of left displaced abomasum and ketosis prevention would reduce the risk of LDA.

The aim of this study was to determinate impact of glucoroticoids (SAID) and nonsteroidical antiiflamatory (NSAID) drugs on milk yield, cow activity, glucose and beta-hydroxybutyrate concentration in blood after omentopexy.

Materials and methods. The research was implemented from 2010 to 2017 in an agricultural company with 800 Lithuanian Black and White cows, including 700 milking cows. Each month, there were 90−100 calving cows. There is no calving seasonality. The farm employs cold rearing conditions, and all the cows were kept in a uniform environment. The dry cows were divided into two groups according to their calving period, and different feeding rations were used. All the milking cows were fed the same total mix ration (TMR) twice a day (0600 and 1800 h) for ad libitum intake. Their diet was composed of 1 kg of straw, 10 kg of hay silage, 15 kg of corn silage, and 8 kg of concentrate 4, containing soybeans, fodder rape, corn, vitamins, protein and minerals. The body condition of the calving cows was 3.5–3.75 (on a 5 point scale). After birth, the calves were separated from the cows within 1.5–2 hours.

For this research, 62 multiparous cows were selected with an average LDA lactation number of 3.5 (±0.9). The average days in milk (DIM) was 35 (±5) days. The LDA was diagnosed during the clinical trial. The physical examination was carried out during the study before surgery (0 d), 7, 14 and 21 days after surgery.

All the cows with LDA had surgical treatment according to a right paralumbar fossa omentopexy. The right paralumbar fossa area was surgically prepared. A 2% lidocaine solution (Procamidor 20 mg/ml solution for injection, Richter Pharma AG, 4600 Wels, Austria) was infused in an inverted 'L-shape' fashion. A 20 cm vertical skin incision was made at the centre of the sublumbar fossa, 10 cm caudal to the most posterior aspect of the last rib. The external oblique muscle was incised in a similar fashion. The internal oblique was incised bluntly along its fibres, whilst the transversalis muscle and peritoneum were incised vertically. The surgeon's hand was placed inside the abdominal cavity, lightly touching the peritoneal surface of the body wall. The abomasum was located by moving the hand down the right abdominal wall to the floor and up the other side, under the rumen. Previously, the trapped gas would have been released using a needle and rubber tubing reaching to the exterior; however, in the last few years, the gas has been released by pushing the abomasum down to the midline and replacing it into its correct position on the right hand side of the abdomen. The pyloric sphincter region and proximal duodenum were exteriorised so that the omentum adjacent to the sphincter region could be visualised. An area of omentum, 2 cm × 2 cm within 5 cm of the pyloric sphincter, was stitched in a continuous 'through and through' pattern, using a polyamide suture and a round-bodied needle. The two ends of the polyamide were sutured through the peritoneum and transversalis muscle and tied with a simple suture midway between the abdominal incision and the final rib. The peritoneum/transversalis layer and both abdominal muscles were sutured separately using chromic catgut in a simple continuous fashion. The skin was closed using the aforementioned polyamide in a continuous Ford interlocking suture pattern.

All the cows were given a hypertonic saline (5 ml/kg of 7.2% NaCl, 3l infusion for a 600 kg cow over five to six minutes) post-operatively. For all the cows after surgery, a Pen-strep 20/20 (Penicillin G Procaine 200,000 iu – Dihydrostreptomycin sulphate 200 mg/ ml was used, administered by intramuscular injection, 1 ml per 20 kg body weight daily, for 3 days. For ketosis prevention, the cows were given 0.300 kg of monopropylenglycol for 14 days after surgical correction (Herdt, 2000). The total number of cows that were diagnosed with LDA was 62.

According to the additional treatment plan, the cows were divided into three groups:

The first group (SAID) of cows were injected with glucocorticoids after surgery DEXAJECT™, (2 mg per mL, Bimeda-MTC Animal Health Inc., Cambridge, ON Canada), with one 20 mg dose, intravenously), n=21.

The second group (NSAID1) of cows were injected NSAID with Rimadyl Cattle (carprofen 50 mg/ml) after surgery. This was an intravenous injection at a dosage of 1.4 mg carprofen per kg body weight (1 ml/35 kg), n=21.

The third group (NSAID2) of cows were injected NSAID with a single intravenous injection of Loxicom 20mg/ml after surgery at a dosage of 0.5 mg meloxicam/kg body weight (i.e., 2.5 ml/100kg body weight), n=20.

For the purpose of biochemical testing, blood samples were collected from v. coccigea right before the surgery (Day 0), and three days (Day 7), fourteen days (Day 14), and twenty-one days (Day 21) after the surgery. The blood serum was tested for the following parameters: calcium (Ca, mmol/l), phosphorus (P, mmol/l), magnesium (Mg, mmol/l), aspartataminotranspherase (AST, U/l), albumines (Alb, g/l), hydroxybutyrates (BHB, mmol/l), glucose (Glu. mmol/l). The blood serum was measured by a computerized Hitachi 705 analyser (Hitachi, Japan) using a DiaSys (Diagnostic Systems GmbH, Germany).

For date accumulation and analysis, a C21 Herd Management Software Dairy Plan was used. The milk yield (MY, kg/d) and cow activity (ACT steps/h) were register. This data was recorded before the surgery (Day 0), and three days (Day 7), fourteen days (Day 14), and twenty-one days (Day 21) after the surgery.

The test data was processed using an SPSS statistical package (SPSS for Windows 15.0, SPSS Inc., Chicago, IL, USA, 2006). The data was considered to be reliable from the statistical point of view when $p < 0.05$.

Results and discussions. Statistically reliable study data was found on glucose, BHB concentration, MY and cow activity.

Glucose concentration. During the study, the average glucose concentration on the day of surgery was 2.2 (±0.2) (SAID), 2.3 (±0.23) (NSAID1) and 2.2 (±0.24)

(NSAID2). 7 days after the surgery, the SAID group glucose concentration increased to 3.5 (0.32) ($p<0.005$) and remained elevated throughout the study. NSAID1, 7 days after surgery, increased to 2.4 (±0.21), on day 14, 2.7 (±0.32) and on day 21, 3.2 (0.12). NSAID2 on day 7 was 2.3 (±0.22), on day 14, 2.6 (±0.32) and on day 21, 3.2 (0.22) (Fig.1).

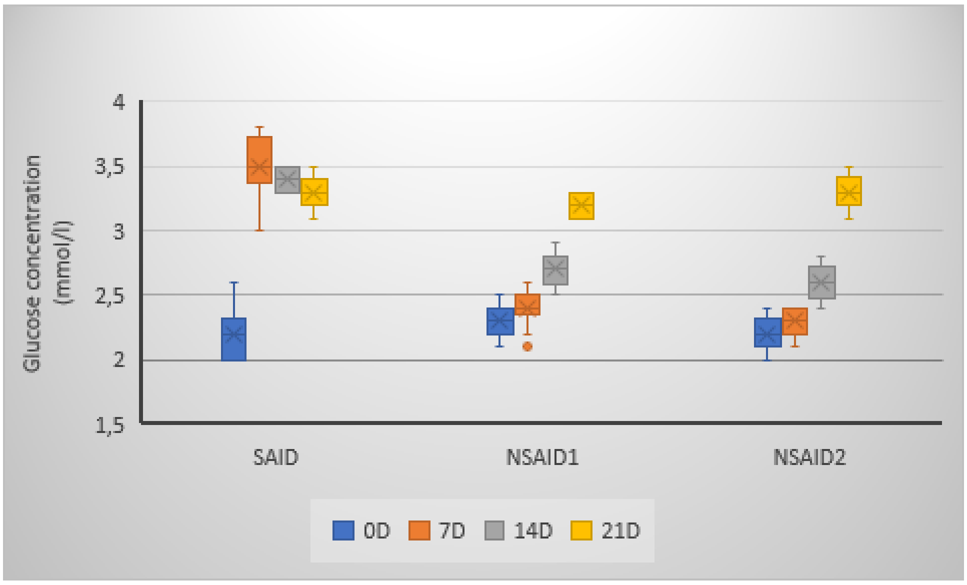

Fig. 1. **Glucose concentration during the study**

It can be stated that during this study, steroidal drugs affected the increase in the glucose level. According Er et al., (2016) increased glucose levels within the first day have been reported in sheep after dexamethasone treatment.It is well known that glucocorticoids increase serum glucose levels by impairing the peripheral consumption of glucose (Macfarlane et al 2008), decreasing glucose utilization, and increasing hepatic production (Moghadam-Kia and Werth 2010); hence, hyperglycemia occurs. Reduced glucose and amino acid consumption and protein synthesis in muscle tissue may have occurred in glucocorticoid treated cows, and may have contributed to the higher glucose concentrations found in their plasma. Similarly, glucose consumption in adipose tissue may have been decreased, as has been demonstrated in rats (Burén et al., 2008).

Betahydoxybutirat concentration. The average BHB concentration during the study on day 1.1 of the surgery (±0.4) (SAID), 0.9 (±0.45) (NSAID1) and 1.2 (±0.32) (NSAID2). 7 days after surgery, the SAID group's BHB decreased to 0.5 (±0.17) ($p<0.005$), 0.3 (±0.1) and 0.3 (±0.15). (. 7 days after surgery, NSAID1 decreased to 0.7 (±0.34), on day 14, 0.6 (±0.22) and on day 21, 0.7 (0.32). NSAID2 on day 7 was 0.9 (±0.35), on day 14, 0.8 (±0.35) and on day 21, 0.7 (0.32) (Fig.2).

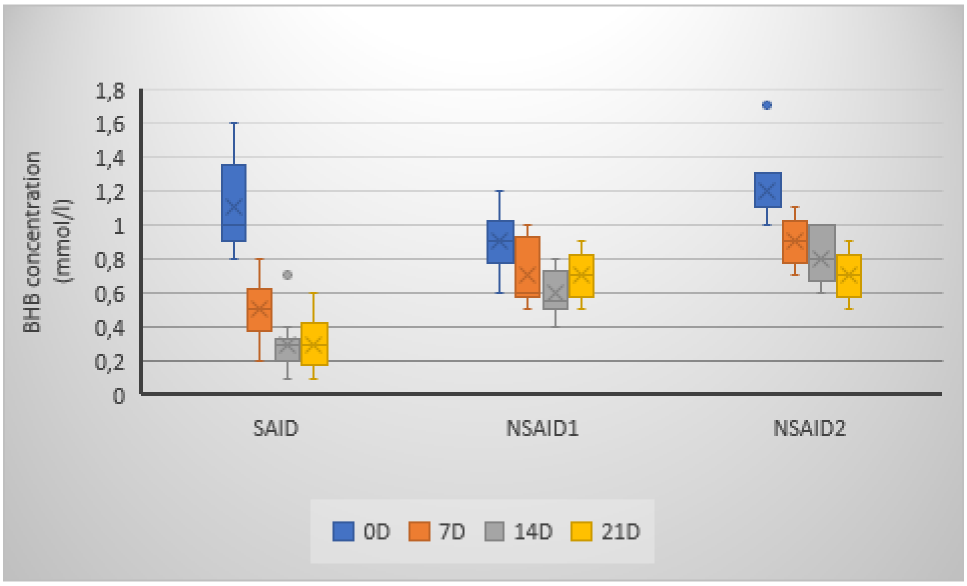

Fig. 2. **BHB concentration during the study**

It can be stated that during this study, steroidal drugs affected the decrease found in the BHB level. Cows with clinical ketosis had lower plasma BHB concentrations for 6 days after treatment when glucocorticoids and glucogenic supplements were combined (Koets et al., 2015). The lack of effect of dexamethasone on the mean plasma BHB concentrations observed in this study is in agreement with results reported previously. The treatment with dexamethasone-21-isonicotinate induces insulin resistance in early lactating dairy cows 5 days after the correction of LDA (Kusenda et al., 2013).

Milk Yield. The average MY during the study on the day of surgery was 12 kg/d (±2) (SAID), 10 kg/d (±3) (NSAID1) and 13 kg/d (±2) (NSAID2). 7 days after surgery, the SAID group MY increased to 22 (±2), and the NSAID1 MY increased to 23 kg/d (±2). 7 days after surgery, the NSAID2 MY increased to 18 kg/d (±3). During days 7 and 14, the MY NSAID1 gr was higher ($p<0.005$) as compared to SAID and NSAID2 during the same period (Fig. 3).

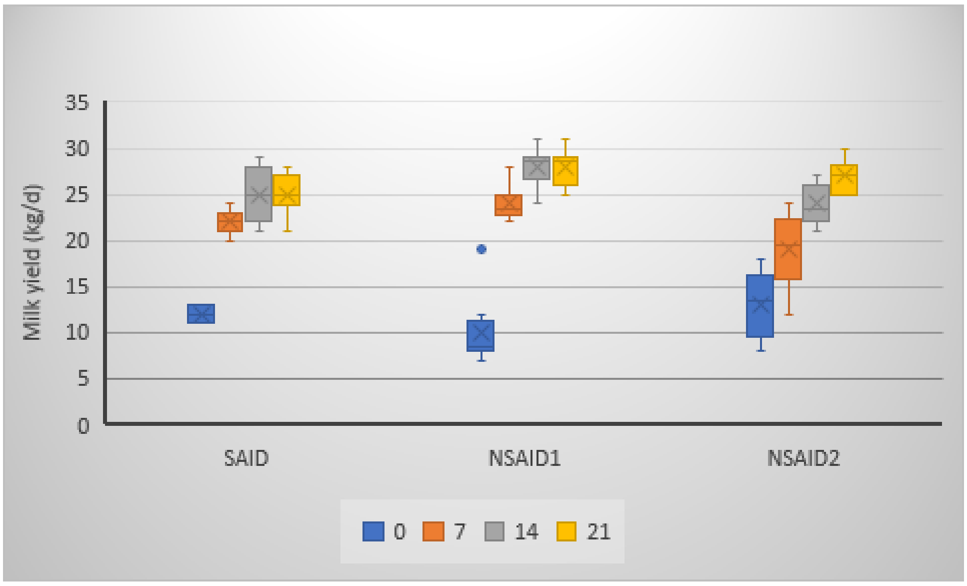

Fig. 3. **Milk yield during the study**

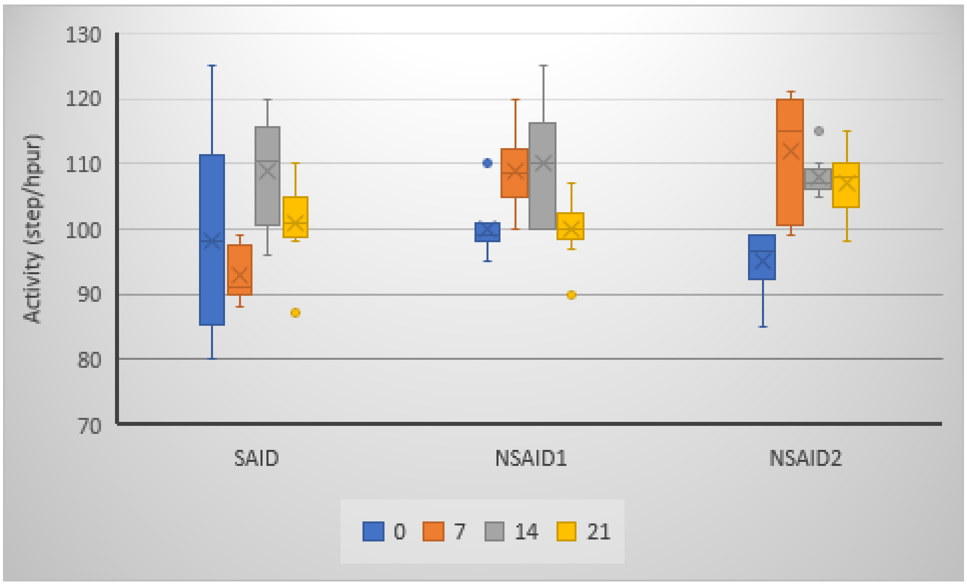

Fig. 4. **Activity during the study**

According Coffer et al. (2006) glucocorticoid treatment reduces milk production in healthy dairy cows (, 2006), but not in ketotic cows. Glucocorticoids have been shown to reduce milk production in most healthy dairy cows (Coffer et al., 2006), but not in all the studies (Jorritsma et al., 2004). Hartmann and Kronfeld (1973) demonstrated reduced mammary consumption of glucose following the administration of dexamethasone. A reduced glucose drain for lactose production by the mammary gland would provide a plausible explanation for the rise in blood glucose concentrations. However, in cows with clinical ketosis, a reduction in milk production was not observed after treatment with glucocorticoids. Perhaps the most important confounding effect on the results of the NSAID trials was the measurement of the duration of milk production. Early-lactation treatment with NSAID from 2 different classes increased the whole-lactation milk yield by 7 to 9%, within only a 3 day treatment window (Carpenter et al., 2016). In our study, we found that the injection of carprofen increased milk production.

Cow activity. The activity on day 7 increased in the NSAID1 and NSAID2 groups as compared with SAID ($p<0.005$). During days 14 and 21, it was found any statistical significant difference (Fig. 4).

According to the study by Edwards and Tozer (2004), heifers walked longer distances than multiparous cows during early lactation. These authors demonstrated that healthy cows were more active (number of steps taken per hour) than cows with metabolic or digestive problems. Cattle activity is associated with symptoms used to define health condition, and it normally increases before the emergence of symptoms indicative of a clinical disorder (Edwards, Tozer 2004). In accordance with J. B. Adewuyi and other researchers (2006), the activity of an animal and variation in milk production are considered to reliably indicate pathological changes taking place in the body. A negative correlation was found to exist between the activity and the following of some symptom of ketosis. The increase in animal activity before the detection of a disease might be associated with increasing stress (Antanaitis et al., 2010).

It can be concluded that SAID injection after an omentopexy increases the glucose level, MY, decreases the BHB level in blood. NSAID injection has a positive effect on the MY and cow activity. According this conclusion after omentopexy is better to use NSAID.

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