

## PREVALENCE AND ANATOMICAL DISTRIBUTION OF EQUINE GASTRIC ULCERATION SYNDROME (EGUS) IN 190 HORSES IN LITHUANIA

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**Abstract.** Equine gastric ulceration syndrome (EGUS) was first described in 1986 and is common in all horses, particularly in those involved in various disciplines, resulting in decreased performance and economic loss. The prevalence and severity of EGUS have been correlated with type of training and management practices. Gastric ulcers have been loosely associated with a range of clinical signs in adult horses. In 2014 were offered disease differentiation by lesion localization in glandular (EGGD) or squamous (ESGD) part of the stomach, number of studies showed that differently localized lesions are caused by different reasons.

**Objectives:** To investigate the prevalence and anatomical distribution of EGUS in a population of Lithuanian horses and association between stomach lesion and anatomical location in the stomach.

**Study design:** the two stages study was performed in 2017 to review 2008-2017 examined animals in Large animal clinic and in 2016 in slaughterhouse during students master thesis.

**Methods.** A total of 190 horses from the Large Animal Clinic (LAC) and a slaughterhouse were examined to determine the prevalence of EGUS, association between stomach lesion and anatomical location and analyse the influence of risk factors amongst Lithuanian horses in 2008 – 2017 period. LAC patients were examined endoscopically, while horses from slaughterhouse were macroscopically evaluated post-mortem.

**Conclusions.** It was observed that the highest severity score of stomach ulcers appeared on both parts of the stomach mucous. Data is insignificant ( $P > 0.05$ ), but tendency is evident.

**Keywords:** Horse, EGUS, EGGD, ESGD, Glandular, Squamous, Stomach

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**Introduction.** Main task of this study was to investigate the prevalence and anatomical distribution of EGUS in a population of 190 horses in Lithuania and assess association between stomach lesion severity and lesion anatomical location in the stomach. This study objective was to describe the prevalence, anatomical distribution, severity and amount of gastric ulceration lesions in a population of 104 number horses treated in LUHS Large animal clinic and in 86 draft horses; to investigate finding differences for groups based on age, sex and physical activity.

The importance of this study was to show how equine stomach ulceration syndrome (EGUS) is common for horses. EGUS has no typical symptoms and this is confirmed by foreign authors' studies. Horses that were examined in this study were treated for a variety of diseases in the LUHS Large animal clinic, and just after they experienced at least one possible common symptom, they had an endoscopic examination. Foreign authors describe the symptoms only as possible for this disease; they are also suitable for all other digestive tract diseases. Therefore, the purpose of this study is to point out that even those horses that had no symptoms may be at risk for EGUS. Horse stomach ulceration cause a lot of economic losses to owners and suffering for horses; EGUS should be controlled and treated immediately.

The term Equine gastric ulcer syndrome (EGUS) was first used in 1999 (Andrews et al., 1999). However, the terminology is tending to be misused (Merritt, 2009). The

European College of Equine Internal Medicine (ECEIM) reinforces the importance of distinguishing between two separate diseases of squamous and glandular mucosa, highlighting important differences. It was offered disease differentiation by lesion localization in glandular (EGGD) or squamous (ESGD) parts of the stomach, studies has shown that lesions in different sites are caused by distinct reasons, the terms used to more specifically describe the affected stomach region anatomically (Sykes et al., 2015; Hepburn, 2014; Berschneider et al., 1999).

The prevalence of equine gastric ulceration varies within a lot of variables. The highest prevalence of ESGD occurs in Thoroughbred racehorses from 37% increasing to 82% (Vatistas et al., 1999). Standardbred racehorses ESGD prevalence rises up to 87% in training (Rabuffo et al., 2002). Similar numbers in endurance horses starting from 48% in non-competition season, which rises up to 93% during the competition period (Nieto et al., 2004; Tamzali et al., 2011). Horses that were rarely used in sports have ESGD prevalence of 11% (Chameroy et al., 2006). The occurrence of EGGD is not that well understood. In Australian Thoroughbred racehorses have reported prevalence from 47% to 65% (Beg and O'Sullivan, 2003; Sykes et al., 2015). The EGGD prevalence in endurance horses is 16% in non-competition period and 27–33% while competing (Nieto et al., 2004; Tamzali et al., 2011). Study in the United Kingdom found EGGD in 54% of 191 leisure horses and in 64% of 493 sport horses (Vatistas et al., 1999). Thoroughbred and Standardbred breeds were

more likely to have ulcers than cold-blooded horses (Sandin et al., 1999).

A lot large scale of epidemiologic studies investigated the risk factors and associations between many agents. Those studies suggested that many factors might predispose ESGD to Thoroughbreds (Sykes et al., 2015). Significant associations have been shown between ESGD and individual horse trainers, as well as horses trained in urban areas, lack of direct contact with other horses, solid barriers instead of rails, and talk rather than music radio playing in the barn (Lester et al., 2008). Further large scale work is required to better understand the epidemiologic factors which influence EGD development (Sykes et al., 2015).

The EGUS is associated with these clinical signs: poor appetite and body condition, recurrent colic, abdominal discomfort, chronic diarrhoea, weight loss, behavioural changes. The occurrence of EGUS was significantly greater in horses with several clinical signs than in those not showing any clinical signs described. (Sykes et al., 2015; Vatisas et al., 1999; Murray et al., 1989; Andrews and Nadeu, 1999).

The ECEIM considers that gastroscopy is the only reliable method identifying gastric ulceration in equine patients. It is essential to examine the entire stomach, including the pylorus and proximal duodenum during gastroscopy (Beg and O'Sullivan, 2003; Murray et al., 2001; Lutherson et al., 2009). In 1999 the Equine Gastric Ulcer Council proposed a 0–4 grading system (Andrews et al., 1999).

Table 1. EGUS grading system [19]

Score	Definition
0	The epithelium is intact and there is no appearance of hyperkeratosis
I	The mucosa is intact, but there are areas of hyperkeratosis
II	Small, single or multifocal lesions
III	Large single or extensive superficial lesions
IV	Extensive lesions with areas of apparent deep ulceration

**Materials and methods.** The study of two stages was performed in Lithuania from 2008 till 2017 analysing results of Lithuanian University of Health and Science Veterinary Academy large animal clinics patients, which were examined endoscopically (n=104). Endoscopies were performed based on related clinical signs and symptoms of EGUS, using Olympus (Japan) endoscope and VideoMed (Germany) video system. Gastric endoscopy examinations were performed for horses, which have experienced at least one or more common clinical symptoms described by authors. Clinical signs including poor appetite, weight loss or poor body condition, recurrent colic, behavioural changes, poor performance and chronic diarrhoea. Before examination horses were starved for at least 12 hours, common clinical examination was performed before anesthesia to evaluate heart and vascular and respiratory systems status. Horses were anesthetized with detomidine

hydrochloride IV route (Cepesedan 10 mg/ml, Germany) doses depending on weight, health status and temperament type. During the endoscopy, the stomach was inflated by insufflation of air through the endoscope biopsy channel until the squamous and glandular regions of the gastric mucosa were clearly visible. Gastric contents were rinsed from the stomach wall surface using tap water flushed through the biopsy channel. After endoscope passes through esophagus to the stomach, firstly, right side and the major curvature of the stomach were evaluated; the endoscope was pushed forward and transported by the right side of the stomach. As the body of the endoscope passed around the major curvature of the stomach, the minor curvature and cardiac part were visible. To observe the antrum and pylorus, the endoscope was pushed further until it had passed ventrally into the deepest portion of the stomach, where it submerged through the gastric fluid. While endoscope was pushed towards pylorus and with stomach smooth muscle movement, end of the endoscope entered into the duodenum, typically no further than the major duodenal papilla. During the endoscopic examination images and video were captured and stored in computer memory.

Second stage study was performed in one slaughter house during student's veterinary medicine master thesis in year 2014 - 2015. Examined horses in the slaughterhouse were considered to be healthy and not treated for EGUS. All 86 (n = 86) horses stomachs were examined immediately after slaughter. Gastric content samples were taken for gastric acid pH testing, inserting electrode of MT 51 pH-meter (Mettler-Toledo, Switzerland) directly into stomach content and registering the momentum pH reading. Stomachs were opened with sharp scissors through the *curvatura major*, rinsed and photographed from both sides making macro-images of various lesions found in the stomach mucosa.

In the first stage of this study during a period of 9 years in Large animal clinic 104 horses were examined endoscopically with respect to clinical signs observed. In the beginning in 2008, only 4 gastroscopies were performed and regarding growth of understanding the benefits of treating EGUS in horses. It became helpful and it was significant in 2016 – 16 gastroscopies were performed in the clinic or in the stables. During this period 49 female and 55 male horses of 13 different breeds and activity levels were examined. The age of examined horses varied between 11 month and 14 years.

A total of 190 horses from the Large Animal Clinic (LAC) and a slaughterhouse in Lithuania were evaluated. Stomachs of slaughtered horses were evaluated macroscopically, which identified the nature of lesions and all gastric ulcer lesion scores were evaluated by Andrews (1999) [20]. Statistical analysis done by StatSoft for Windows, used ANOVA LSD test. Data are considered statistically significant when  $P < 0.05$ .

**Results.** Mostly 3<sup>rd</sup> grade gastric ulceration appeared in 46% of horses, most of subjects were males 56% and horses 120-167 month old 38%. Most lesions of 3<sup>rd</sup> grade were localized in both squamous and glandular parts of the stomach in 54% of subjects. Lesions of squamous part were

less detected, than glandular part, respectively 19% and 27%.

2<sup>nd</sup> grade ulcers were diagnosed in 33% horses, most lesions were localized in the squamous part of the stomach in 76% of horses, both stomach parts lesions appeared in 15% subjects. Most of them were males 62% and horses 72-119 month old age 53%.

4<sup>th</sup> score of EGUS were determined in 16% of subjects; damage was also noticeable in both parts of the stomach in 53% and less frequent in the squamous or glandular parts, respectively 29% and 18%. Male and female individuals' ratio was more equal 47% and 53% respectively. Most of horses experienced highest stomach lesions were 0-36 month old 41%. 1<sup>st</sup> EGUS score were detected in least of subjects 5%.

Significant lesion localization dependence on the score of EGUS has not been observed, but there is a tendency noting that the higher EGUS score in the stomach the more damaged areas recorded. In accordance of foreign authors'

studies and the nomenclature proposed by the ECEIM Commission, it is proposed to distinguish between ESGD and EGGD diseases (3), but none of the studies mentioned the assessment of stomach lesions localised in both gastric parts.

In this stage of study most often diagnosed 46% 3<sup>rd</sup> ulceration score. The study observed a tendency that the strengthening of mucosal lesions score number of lesions increases. 3<sup>rd</sup> score lesions usually localized in both parts of the stomach for 54% horses, 4<sup>th</sup> score lesions are also observed around the stomach mucous for 53 % horses.

The study conducted mainly from 72 to 119 months age horses 42%, this group horses are most commonly occurred lesions of 2<sup>nd</sup> and 3<sup>rd</sup> EGUS grade. Gastric ulceration dependence on age was not observed. No gender influence on gastric lesion noted in this study, but on the basis of this research and foreign literature relative risk is higher in male horses.

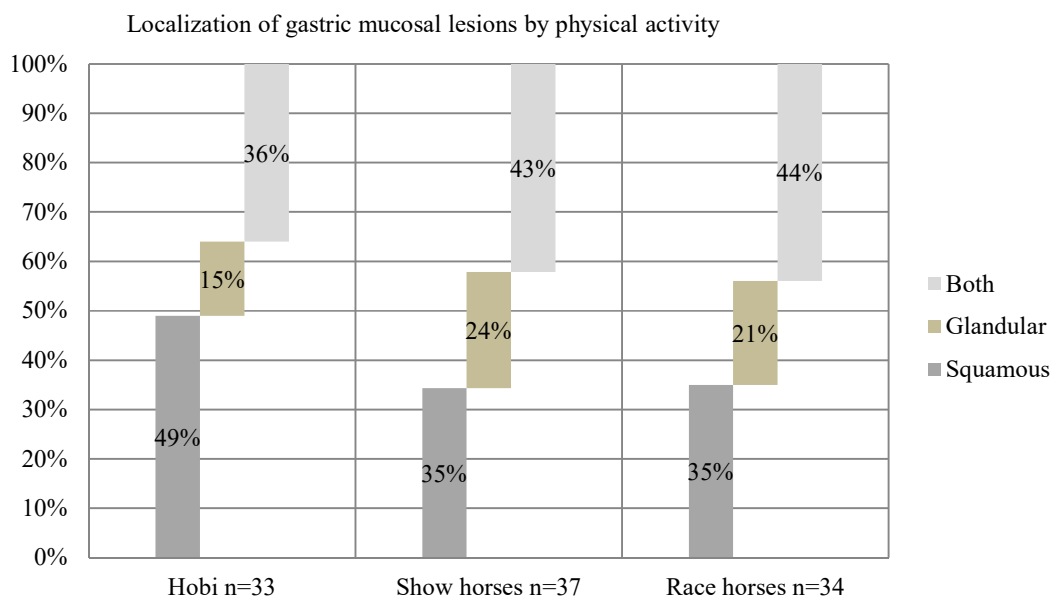


Fig 1. Stomach lesions localization depending on physical activity

In horses with minimal physical activity mostly 3<sup>rd</sup> EGUS grade were diagnosed in 45% subjects. In horses competing in show jumping or dressage, most commonly diagnose were 3<sup>rd</sup> EGUS grade in 49% of subjects. Horses trained and participating in racing (flat racing and trotting) mostly were diagnosed with 3<sup>rd</sup> grade of lesions 43% of horses.

The ESGD was most often diagnosed in 49% of horses in minimal physical activity group, most of them being used as hobby or leisure horses. Equally for show horses and racing horses 35% respectively (13/35) and (12/34) the ESGD were diagnosed. The EGGD was most commonly diagnosed for 24% of show horses.  $P > 0,05$

From second part of the study from slaughtered horses: 86 horses were studied ( $n = 86$ ). Lesions in stomach mucosa were detected for all 100% examined horses. Most

common 2<sup>nd</sup> score in gastric mucosa of EGUS was diagnosed for 49 %. 2<sup>nd</sup> grade lesions were mostly localized in the squamous part of the stomach 62% in the subjects, in glandular part 17%. Both squamous and glandular stomach part lesions were detected in 21%.

Less common 3<sup>rd</sup> score lesions of EGUS were detected in 31% of horses; most lesions were detected on squamous stomach part 67%, less in glandular part 15%. Both stomach parts were damaged in 19% of animals tested. The most severe 4<sup>th</sup> score of EGUS appeared the least 13% of tested horses; lesions were localized on both stomach parts in 55%, on squamous and glandular parts respectively 27% and 18% of horses. The least 1<sup>st</sup> EGUS grade detected in 7% of horses, lesions localized on squamous part were found in 67%.

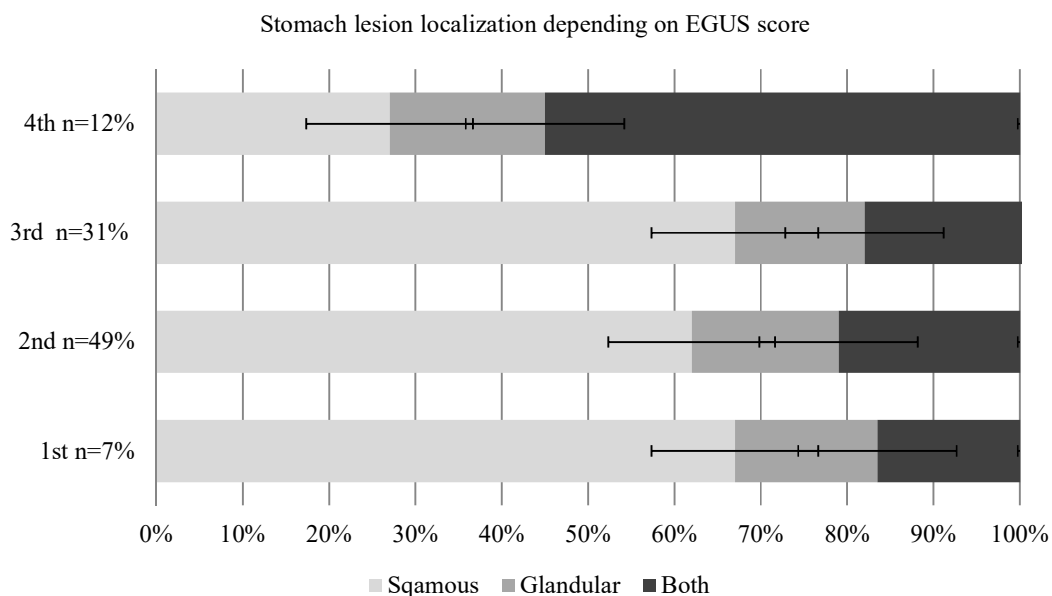


Fig 2. Stomach lesions localization depending on stomach ulceration score

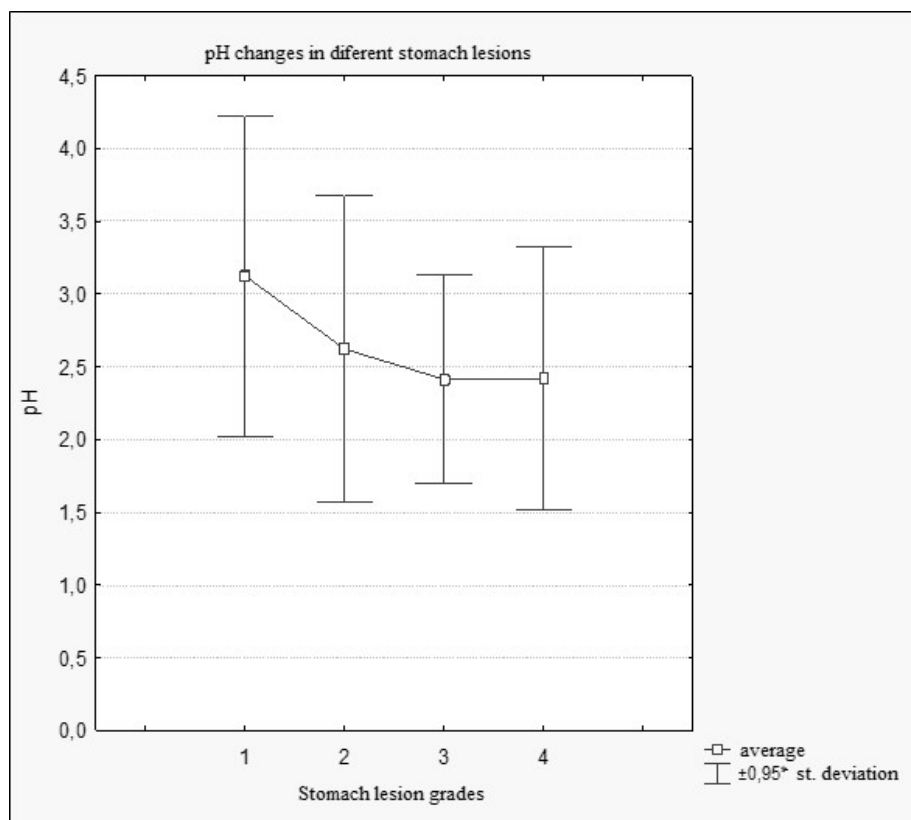


Fig 3. Stomach content pH dependence on EGUS score

Lesion by localization were classified and ESGD and EGGD were diagnosed respectively for 59% and 16% of examined horses, mixed lesions or lesions on both parts were found for 24%.

In this study, mares were tested more than male horses, respectively 59% and 41%. The incidence of mucosal damage depending on gender was similar; there is no significant difference in both genders. All slaughtered

horses were coldblooded breed - Lithuanian draught horse breed with unknown physical activity level.

In gastric content samples from stomachs with 4<sup>th</sup> grade ulceration damage content pH was checked with pH-meter, the results showed lowest pH score 2,26 and pH change was observed in comparison to a lower grade damaged stomachs. Tendency of pH changes noted in following results showing slightly higher pH 2.41 in 3<sup>rd</sup> grade ulcerated stomachs. While 2<sup>nd</sup> grade damaged stomachs showed a pH of 2.60 and pH of least damaged stomachs showed highest pH 3,12 ( $P > 0.05$ ). Data is not significant, but the tendency is evident.

The stomach content pH impact on the score of EGUS is insignificant ( $P > 0.05$ ), but tendentious: the more acidic the stomach content is, the greater the damage to the stomach mucosa.

**Discussion.** Equine gastric ulceration is a common disease and diagnosis should be made with endoscopic examination of gastric mucosa (Sykes et al., 2015). In this study 2<sup>nd</sup> EGUS score were diagnosed 49% slaughtered draught horses. Lesions were classified by localization and ESGD was diagnosed in 59% of subjects. Respectively 3<sup>rd</sup> EGUS score was diagnosed commonly in 46% of LAC examined horses with lesions localised on both parts of the stomach 54%. In this study most often ESGD diagnosed for 72-119 month horses 36%, however, lesion localization dependence on age was not detected. ESGD was mostly diagnosed for male horses 44%, while EGGD found evenly in 20% of male and female horses, no correlation between genders remained. ESGD was usually 49% diagnosed in least physical active horses. According to foreign authors work, as well as this study, results revealed that prevalence of ESGD is higher for Thoroughbred horses, regardless of exercise intensity. Referring to foreign authors, Thoroughbreds are mostly diagnosed suffering from ESGD, even those who receive a minimal physical activity - hobby horses (Hepburn, 2014; Sykes et al., 2015; Lester et al., 2008). According to this study and foreign studies concluding that other risk factors have a greater impact on the gastric mucosa than age, gender or physical activity. Racehorses were frequently diagnosed with highest 4<sup>th</sup> score lesions in 24% of them. Also other sport representatives showed that EGUS is associated with exercise intensity and exercise influence on gastric lesion appearance was observed on the basis of this research and foreign authors work. Analyzing age, gender and physical activity impact on the intensity of gastric mucosal lesion localization, and no significant association between age and sex was noticed like in Hepburn study in year of 2014 (Hepburn, 2014). The same results were noticed in 2 large cross-sectional studies of Thoroughbred racehorses, researchers documented no significant effect of age or sex on the likelihood of having ESGD (Vatistas et al., 1999; Lester et al., 2008).

Our study confirms that gastric ulceration can be prevalent 86/86 in a group of slaughtered apparently clinically healthy draft horses, those horses were not into intensive work and as Lutherson et al., study in year of 2009 shows, horses who had no clinical signs and no intense work was diagnosed with EGUS (Lutherson et al.,

2009). In this study we had no information about slaughtered horse's environment and other precautions conditions, the authors of this study according to foreign authors are suggesting together, that nutrition factors may increase the risk of EGUS development. Lutherson and other authors performed study which confirmed that components of the diet may have an important impact on the risk of EGUS in the non-sport horses (Lutherson et al., 2009). Similar opinions are made in Nadeau in 2000 and later Lybert in 2007 and other author studies. Free access to fibrous feed or frequent forage feeding is widely considered to reduce the risk of gastric ulceration although strong evidence supporting this belief is also lacking. Feeding horses with alfalfa hay and grain can result in higher gastric pH and less peptic injuries to the gastric squamous mucosa, than feeding with grass hay with no grain (Nadeau et al., 2000; Lybert et al., 2007). There is a really small problem which could be fixed just by changing one step in horses daily feeding routine, hay must be given before grain, there is a significant evidence in study performed in 2005 by author Frank and others, their concluded that there is a marked increase in ulceration when non-sport horses are stabled and fed grain at 1% of BW, 1 hour before hay is fed (Frank et al., 2005).

To conclude, in this study 2<sup>nd</sup> EGUS score was diagnosed most often in 40% of horses, 3<sup>rd</sup> in 39%, 4<sup>th</sup> in 15% and 1<sup>st</sup> in 6 % of all 190 examined horses. ESGD was mostly diagnosed in 49% of subjects, EGGD in 18% and both stomach parts lesions were detected in 33% of all horses. The effect of stomach content pH on the score of EGUS is ( $P > 0.05$ ) tendentious: the more acidic the stomach content, the greater is damage to the stomach mucous. There is a tendency ( $P > 0.05$ ) that increasing EGUS grade correlates with an increasing injured area amount in the stomach.

A large amount of lesions were observed in both parts of the stomach. According to the literature of foreign authors and the nomenclature proposed by the ECEIM Commission, it is proposed to separate the ESGD and the EGGD and evaluate them differently (Sykes et al., 2015), but none of the studies mentioned the assessment of both gastro-intestinal lesions.

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