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PREVALENCE AND RISK FACTORS OF EQUINE GASTRIC ULCER SYNDROME AT A SINGLE SPORT HORSE FACILITY

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Abstract

Equine gastric ulcer syndrome (EGUS) is a common disease that impacts horse welfare. This study aimed to estimate the prevalence of gastric ulcers (GUs) in the squamous and glandular portions, as well as their simultaneous manifestation, and determine the associated risk factors in sport horses at an equestrian complex in Colombia. Of 50 horses, 23 (46 %) had GU in any of the stomach portions, 15 (30 %) had equine squamous gastric disease (ESDG), 17 (34 %) had equine gastric glandular disease (EGGD), and 9 (18 %) had ESDG and EGGD. Among the affected horses, 26.09 % had ESDG, 34.78 % had EGGD, and 39.13 % had both. A significant association was found between GU in any portion and breed (OR = 2.36, CI = 1.116–3.262), colic in the last year (OR = 2.516, CI = 1.63–10.042), previous diagnosis of GU (OR = 2.476, CI = 1.21–29.227), and not being stabled (OR = 5.479, CI = 2.566–52.969). EGGD was associated with concentrate consumption at <2 kg/meal (OR = 2.095, CI = 1.599–7.333), grazing <2 hours daily (OR = 4.636, CI = 1.684–31.435), and not being stabled (OR = 5.032, CI = 1.004–21.405). There was also a significant association between GU in both portions and previous diagnosis of GU (OR = 2.438, CI = 2.196–30.337). The manifestation of the disease between the stomach portions was significantly correlated ($p < 0.05$). The results demonstrated a significant prevalence of EGUS (46 %) in the horses at the equestrian complex, highlighting several related risk factors.

Keywords: EGUS; equine; gastric; gastroscopy; ulcer.

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PREVALENCIA Y FACTORES DE RIESGO DEL SÍNDROME DE ÚLCERA GÁSTRICA EQUINA EN UN SOLO CENTRO HÍPICO

Resumen

El síndrome de úlcera gástrica en equinos (SUGE) impacta el bienestar de los caballos. El objetivo de este estudio es estimar la prevalencia de úlceras gástricas (UG) de las porciones escamosa y glandular, así como su presentación simultánea, y determinar sus factores de riesgo en caballos de deporte de un centro hípico en Colombia. De los 50 caballos estudiados, 23 (46 %) presentaron UG en alguna porción del estómago; 15 (30 %), enfermedad gástrica escamosa equina (EGEE); 17 (34 %), enfermedad gástrica glandular equina (EGGE) y 9 (18 %), EGEE y EGGE al tiempo. De los caballos afectados, 26,09 % presentó EGEE; 34,78 %, EGGE, y 39,13 %, ambas simultáneamente. Se encontró una asociación significativa entre UG en cualquier porción y raza (OR = 2,36; IC = 1,116-3,262), cólico durante el último año (OR = 2,516; IC = 1,63-10,042), diagnóstico previo de UG (OR = 2,476; IC = 1,21-29,227) y no estar estabulados (OR = 5,479; IC = 2,566-52,969). También hubo una relación significativa entre EGGE y consumo de concentrado <2 kg/ración (OR = 2,095; IC = 1,599-7,333), <2 horas pastoreo día (OR = 4,636; IC = 1,684-31,435) y no estar estabulados (OR = 5,032; IC = 1,004-21,405). Se halló una asociación significativa entre presentación de UG en ambas porciones y diagnóstico previo de UG (OR = 2,438; IC = 2,196-30,337). La presentación de la enfermedad entre las porciones estomacales estuvo significativamente asociada ($p < 0.05$). Los resultados muestran una prevalencia significativa de SUGE (46 %) en los caballos estudiados y ayudan a determinar factores de riesgo asociados.

Palabras clave: SUGE; equino; gástrica; gastroscopia; úlcera.

INTRODUCCIÓN

Equine gastric ulcer syndrome (egus) is a highly prevalent clinical syndrome with a multifactorial origin that significantly impacts the horse industry (1,2). Gastric ulcers (gus) have been identified in various regions of the stomach (3,4), which has recently led to the proposal of differentiating between equine squamous gastric disease (esdg) and equine glandular gastric disease (eggd) (5). Several factors interact to cause them, and despite continuous investigation, the etiology has not been fully elucidated to date (6).

Several risk factors for egus have been reported such as the Thoroughbred breed (7), age, sex (8), demanding exercise (9), abdominal pressure (10), training (11), performance (12), temperament (13), prolonged transportation (14), changes in the usual environments or stabling without access to pasture (13,15), diets high in starch, low forages and limited access

to water (16,17), as well as the difficulty in maintaining weight and eating habits (18,19).

When eggd and esdg have been studied independently, the risk factors differ notably between the two entities. In eggd cases, the high number of caretakers and riders (20), sex, coach, the inability to access pastures, quick work a few days a week, and swimming (21), as well as stress (18,22,23) and the use of nonsteroidal anti-inflammatory drugs (nsaids) (24), have been significantly associated with the disease. A recent study determined differences between eggd and esdg risk factors. Exercising ≥5 days per week was associated with an increased risk of eggd. Horses performing below expectations were also more likely to have eggd. The trainer was identified as a risk factor for eggd. However, a decreased risk of esdg was observed when the time in work was ≤6 weeks. Horses with stereotypies had a higher possibility of having esdg, but horses exhibiting aggressive behavior towards humans were less likely to have esdg (25).

The purpose of this study was to estimate the prevalence of gastric ulcers of the squamous and glandular portions, as well as their simultaneous occurrence, and to determine their risk factors in sport horses at an equestrian complex in Colombia.

MATERIALS AND METHODS

A cross-sectional study was conducted using a purposive sample in a population of 64 horses residing in an equestrian complex located at 2,600 meters above sea level in Bogotá, Colombia (4º40'52.6"N 74º04'14.3"W). The inclusion criteria were: 1) to be part of the population for at least two years, 2) to have a certain sport or instructional activity, 3) no evidence of disease, 4) no treatments for egus within the previous year, and 5) to have informed consent from their owners. A survey was conducted for each horse included in this study. The factors that the literature has shown to influence the occurrence of egus were assessed (12,21,25).

GASTROSCOPY

A fasting period of 12 to 16 hours was observed, and water was withheld for 4 to 8 hours before each gastroscopy procedure (26). A naso-esophageal tube was used to direct the 3-meter-long (OlympusR)1 endoscope to the esophagus and the stomach, under sedation with

xylazine (Ana Sed®)2 at a dose of 1.1 mg/kg IV.

Diverging from the traditionally reported gastroscopy technique (26–28), this study initiated observations at the pyloric antrum, proceeding outwardly towards the glandular portion, the margo plicatus, the squamous portion, the cardia, and the esophagus. Video and photographic images of all the gastroscopies were recorded for later analysis by the two researchers to determine the degree of ulceration.

GRADING SYSTEM

To grade the severity of gus in the squamous and glandular portions, the score system proposed by Sykes and Jokisalo (6,26) was implemented (Table 1).

Table 1. Grading System for the Squamous and Glandular Mucosa

	Squamous mucosa	Glandular mucosa
Grade 0	The epithelium is intact and there is no appearance of hyperkeratosis (yellowing of the mucosa), hyperemia	The epithelium is intact and there is no evidence of
Grade 1	The mucosa is intact but there are areas of hyperkeratosis	The mucosa is intact but there are areas of hyperemia
Grade 2	Small, single or multifocal (<5) superficial lesions	Small, single or multifocal (<5) superficial lesions
Grade 3	Large, single deep, or multiple (≥5) focal superficial lesions	Large single deep or multiple (≥5) focal lesions
Grade 4	Extensive lesions with areas of apparent deep ulceration	Extensive lesions with areas of apparent deep ulceration

Source: Taken from (26 p546).

DETERMINATION OF PREVALENCE

The prevalence of the disease manifestation in each portion was determined using Equation 1 (29).

$$Prevalence\ of\ GU\ in\ each\ portion = \frac{\text{Number of all animals with gu in each portion}}{\text{Total number of study animals}} \times 100 \quad (1)$$

DATA ANALYSIS

A descriptive analysis of each quantitative variable was performed. Furthermore, for the qualitative variables, frequency tables were developed along with their respective graphs. Then a bivariate analysis was conducted between gus and each of the independent variables, using the chi-square test ($\chi 2$). The statistical significance used was 5 % ($\alpha = 0.05$) (11). The odds ratios were calculated independently, and then a logistic regression model was constructed between gu and the variables with which a significant association was found, evaluating the model's adjustment in each case (30).

The procedures were performed using the ibm spss version 2.0 program.3

RESULTS

Out of the 64 horses in the equestrian complex, only 50 met the inclusion criteria. Twenty-six horses (52 %) were purebred (Thoroughbred, Selle Francais, Silla Argentino) and 24 (48 %) mixed breeds; 30 (60 %) were geldings and 20 (40 %) mares. The mean age was 13 years, with an average body condition of 6/9 (31), and the weight range was between 460 and 520 kg. Colic was reported in 11 horses (22 %) during the previous year, 3 (6 %) had a previous diagnosis of gu, 12 (24 %) reported the use of nsaids during the last year, and 5 (10 %) reported weight loss. Forty-four horses (88 %) received a mixture of equal amounts of a commercial concentrate and oats at a rate of 1 % of their body weight divided into two rations per day. In comparison, the remaining 6 (12 %) horses did not consume any grain. Kikuyo grass was fed every other day with Pangola hay, both at a rate of 1.5 % of body weight

per day; 28 (56 %) are fed more than 2 kg of grain per feeding, this was based on the horses' height, weight or work load; 45 (90 %) grazed more than 2 hours a day with an average of 8 hours, including the total of horses that live in conditions of continuous grazing. Forty-four horses (88 %) are stabled, 17 (34 %) compete, 21 (42 %) have teaching functions, 12 (24 %) do not do any work, 35 (70 %) work less than an hour a day, 41 (82 %) are considered representatives of some discipline, 17 (34 %) have been transported, and 31 (62 %) have a single rider.

Of the 50 horses in the study, 23 presented with gu in any of the stomach portions (46 %), 15 had esdg (30 %), 17 had eggd (34 %), and 9 (18 %) exhibited lesions in both esdg and eggd (Figures 1-3).

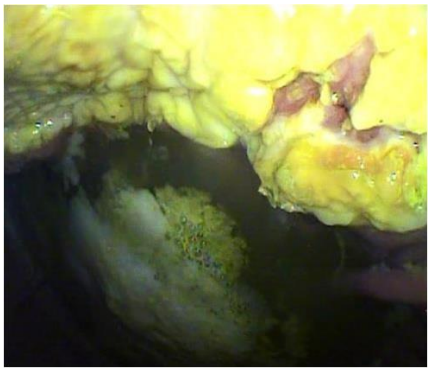

Figure 1. Endoscopic Image of the Squamous Portion of a Studied Equine. Localized Ulcerative Lesions. Classification 3/4

Figure 2. Endoscopic Image of an Equine Pylorus. Evidence of Multiple Lesions. Classification 2/4

Figure 3. Endoscopic Image of Minor Curvature from the Pyloric Antrum. Evidence of Localized Ulcerative Lesion. Classification 1/4

Of the 23 horses with gu, it was observed that 26.09 % had esdg, 34.78 % had eggd, and 39.13 % had both simultaneously.

The bivariate analysis revealed a significant association between the presence of gu and the following variables, depending on their location (Table 2).

Table 2. Risk Factors Associated with the Manifestation of gu According to the Affected Region of the Stomach

Independent variable	Sig.	or	ci (95 %)	
gu in any portion				
Breed	0.004	2.36	1.16	3.262
Colic last year	0.008	2.516	1.63	10.042
Previous diagnosis of gu	0.009	2.476	1.21	29.227
Not stabled	0.008	5.479	2.56	52.969
gu in the squamous portion				
Concentrate <2kg per ration	0.043	2.095	1.599	7.333
Grazing <2 hours a day	0.003	4.636	1.684	31.435
Not stabled	0.003	5.032	1.004	21.405
gu in both portions				
Previous diagnosis of gu	0.046	2.438	2.196	30.237

The presence of gu in certain regions was associated ($p < 0.05$) with its occurrence in other portions simultaneously, as reflected in the ors obtained and presented in Table 3.

Table 3. Association of the Occurrence of gu with Different Stomach Portions

Variable	Sig.	or	ci (95 %)	
gu in any portion with Squamous gu	0.000	0.391	0.23	0.651
Glandular gu	0.000	0.261	0.13	0.519
gu in both regions	0.000	0.609	0.43	0.845
Squamous gu with Glandular gu	0.031	4.000	1.090	14.675
gu in both regions	0.000	46.667	4.909	443.661
Glandular gu with gu in both regions	0.000	0.471	0.284	0.779

When constructing the logistic regression model between the different manifestations of gu and the variables, a significant association was not found. Although the Hosmer and Lemeshow tests suggest a good fit, the coefficients were not significant. Therefore, it was not possible to construct a model to explain the occurrence of gu (30).

DISCUSSION

The gastroscopy technique used in the study allowed the observation of the antrum, pylorus, and eventually the duodenum, an aspect that has been reported to be difficult in some studies (3,32). The fact that it was easier for the researchers to perform it might have been due to the horse breeds. However, it may have disadvantages due to the limitation of endoscope length, which restricts exploration of the most distant sections, compared to the technique commonly used (26).

The ulcer grading system adopted (26,27) proved to be adequate due to its practicality and readiness in describing injuries among researchers (33).

As reported in other studies, gu was observed more frequently in the pyloric antrum, the squamous mucosa along the lesser curvature, and the margo plicatus in the present study (15,34,35).

The gu prevalence (46 %) determined in any of the stomach portions was greater than the reported for egus in horses evaluated postmortem, where 383/3715 (10.3 %) presented with gu (considering that data collection and procedures differ from current knowledge) (7). On the other hand, it is lower than the 83 % reported by Hewetson et al. (36) in horses of different breeds, which was observed in sport functions similar to those in the present study. It was also less than 53 %, as reported for 201 horses of different breeds and sport functions in Denmark (4) and 66.6 % in endurance horses (37).

These different results among studies may be due to the ulcer grading system (6,21,26,38), evolution in diagnostic methods and techniques (39), and the risk factors to which each group of horses was exposed.

The prevalence (30 %) for esdg could be considered low in comparison to the reported prevalence for this region in horses of different functions such as 44–86 % in racehorses((3,12,25,35); endurance, with 48 % between seasons and 93 % during the competition season (11); 67 % after competitive events (37); 58 % in jumping and training horses (13); 47.9 % in eventing horses (40), and 54 % for those used in polo (41).

eggd showed a prevalence of 34 %, which, except for the 16–35% prevalence reported in endurance horses (37) and the 25 % prevalence reported for Thoroughbreds (25), can be considered low compared to what has been reported for this stomach region (40,41). Training and jumping horses showed a prevalence of 55.2 % (22), while it was 70.6 % in domestic horses (42). As in this study, most of the lesions reported in the literature were located in the pyloric antrum (28).

Even though Çetinkaya et al. (43) considered gu in the glandular mucosa to be relatively rare and of little clinical importance in adult horses, current reports have shown that prevalence in the glandular portion is similar to or higher than that in the squamous portion, especially in sport horses (36). Based on this, it is thought that the events involving these equestrian activities seem to have a greater impact on the health of the glandular section than other activities done by the horse (28,32,42).

Hepburn and Proudman (26) point out that in sport and recreational horses, the presence of eggd occurs more frequently alone than in combination with esdg; this contrasts with the present study, where the presence of lesions in both portions was observed.

Regarding the risk factors in this study, grazing for two hours or less per day was associated with esdg (or = 4.6). This short period for grazing may lower the possibility of socializing, cause more stress, and limit salivation and food consumption (6).

Bell et al. (33) and Husted et al. (44) have reported that the changes in the stabling status of equines do not affect the exposure to acid in the different stomach portions.

The most significant risk factor associated with gu in any of the stomach portions (or = 5.4), as well as in the squamous portion (or = 5.0), was not being stabled. These results contrast with most studies, which have observed that access to pastures is a protective factor that is more effective in conditions of company and possible contact among horses (9,45,46).

The fact that horses are on pasture may not be entirely positive for the horses in the present study; it is possible that, in the studied equestrian complex, they may be more neglected and not fed at the same standard as the competing horses, given their limited economic and athletic value. The diet is primarily based on pasture, but its abundance is usually limited. These conditions might place the horses in much more stressful situations. Woodward et al. (47) reported that, under certain conditions, moving horses from pastures to a stable system can be effective in reducing the scores of ulcers in the squamous portion in some cases, which may indicate that being on pasture may be detrimental to the stomach mucosa in stressful situations.

Horses that had <2 kg of concentrate per meal were 2 times more prone to have esdg than the ones that had higher concentrate per meal. However, a confounding factor could be involved because these were also the horses that were not stabled. Additionally, this amount of food per serving was implemented for the mixed-breed horses and for those that were less well cared for, which were also on pasture.

The high consumption of grains has been reported as a risk factor for the disease, due to increases in serum gastrin levels (48) or the high levels of starches related to it (16).

Horses of mixed breeds were at a significantly higher risk of gu in any of the gastric portions (or = 2.36). Although the study did not yield substantial results, several factors, such as the use of horses for teaching purposes, longer working hours, and a high number of riders, could also contribute to this finding.

There have been reports that breed might be a risk factor for gu, as in the cases of

Thoroughbred horses (7) and glandular mucosa ulcers in Warmblood horses (20). Other studies have not been able to establish this association between breed and gu in racing horses (34), endurance horses (11), or horses racing out of competition (16). However, it has been observed that training more than 5 days a week carries a greater risk of eggd (10.4 times) (95% ci 1.3–26.9) (25).

Having at least a colic bout during the previous year was associated (or = 2.5) with the presence of gu in any of the gastric portions. This has been demonstrated in one study, which reported ulcers in 83 % of horses with recurrent colic. Additionally, the study showed that 28 % of these colics were attributable to the gu itself (34). In other studies, gastric ulceration associated with egus was found in 98 % of the studied horses (49). A high prevalence (92 %) of ulcers, gastritis, and gastrointestinal disorders was found in Spanish horses at the time of their euthanasia (50).

Having a previous diagnosis of gu was also associated with the presence of gu in any portion (or = 2.4) and in both portions (or = 2.4). This variable has been considered in both studies of risk factors for the glandular mucosa specifically (20) and in the ones of egus in general (16); however, it has been determined as an exclusion criterion for other studies (3). This association could occur due to inadequate treatment of the animals, the impossibility of significantly reducing the risk factors to which these horses were exposed, or the recurrence of the disease in these individuals.

An association was observed between the presence of the gu and its various locations ($p < 0.05$). However, there are few reported studies with similar findings, and this association has not been determined (28,32). Nonetheless, Tamzali et al. (11) showed that all glandular lesions were associated with squamous lesions.

The present study has several significant limitations. First, a purposive sample was used; second, the sample size was limited; and third, the study was conducted in only one equestrian complex. These facts limited the external validity of this research, thereby reducing its applicability to the broader population. The impossibility of developing a logistic regression model with significant coefficients was possibly due to the limitations of the sample.

The prevalence observed in the present study for the different stomach portions was lower

than most reported for various equestrian activities, but it is considered significant and reflects the multifactorial nature of the disease. The use of the gastroscopy technique, which begins the observation route at the pyloric antrum, offers numerous advantages in terms of access to different regions, as well as the possibility of a more fluid and continuous examination of the stomach.

CONCLUSIONS

In the 50 horses of the study, 23 had gu in any of the stomach portions (46 %), 15 had esdg (30 %), 17 had eggd (34 %), and 9 (18 %) had both esdg and eggd. The risk factors for gu in any portion of sport horses at an equestrian complex in Colombia were breed, colic event during the last year, previous diagnosis of gu, and not being stabled; eggd with concentrate consumption at <2 kg/meal, having <2 hours of grazing daily, and not being stabled; and gu in both portions with a previous diagnosis of gu. The occurrence of the disease between the different stomach portions was significantly associated.

This is the first study on the prevalence of gu syndrome in sport horses and its risk factors in Colombia.

ETHICS IN ANIMAL RESEARCH

All procedures and protocols used to carry out the present research were approved by the Bioethics Committee of the Faculty of Veterinary Medicine and Zootechnics at Universidad Nacional de Colombia, Bogota.

CONFLICT OF INTEREST STATEMENT

No conflicts of interest are declared by the authors.

MANUFACTURER ADDRESSES

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2Lloyd Laboratories, Shenandoah, IA, USA

3International Business Machines Corporation (IBM), NY, USA

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