

INFLUENCE OF STABULATION AND FOOD ON THE DEVELOPMENT OF COLIC SYNDROME IN HORSES

INFLUÊNCIA DA ESTABULAÇÃO E ALIMENTAÇÃO NO DESENVOLVIMENTO DA SÍNDROME CÓLICA EM EQUINOS

Gabriela Martins de **Carvalho*** , Renan **Leite** , Larissa Silva **Braga** , Rodrigo Samuel **Toledo** , Gustavo Romero **Gonçalves** 

UNINGÁ - Centro Universitário Ingá, Maringá, PR, Brasil.

*gabrielamartins98@hotmail.com

ABSTRACT

Colic syndrome is one of the main clinical and surgical emergencies that affect horses of all races and ages, in which if left untreated, it can be fatal. The disease is accompanied by intense systemic signs, and can be converted through medical or surgical clinic, depending on the severity of the case. Knowing the importance of this syndrome, this study aimed to evaluate the influence of housing and feeding on the development of colic, through a literature review. Given the information found, it is concluded that most cases of colic are related to the mismanagement of the animal, especially in relation to food and exercise restriction. Therefore, it is extremely important to inform the owners of these animals about how the supply of food should be done, both in quantity and quality, and about how the practice of physical activity can prevent the development of gastrointestinal disorders.

Keywords: Acute abdomen. Horses. Nutrition. Physical exercise.

RESUMO

A síndrome cólica é uma das principais emergências clínicas e cirúrgicas que acometem equinos de todas as raças e idades, na qual se não tratada, pode ser fatal. A enfermidade vem acompanhada de sinais sistêmicos intensos, e pode ser convertida por meio da clínica médica ou cirúrgica, dependendo da gravidade do caso. Sabendo da importância dessa síndrome, o presente trabalho teve como objetivo avaliar a influência da estabulação e da alimentação no desenvolvimento da cólica, através da revisão bibliográfica. Diante das informações encontradas, conclui-se que a maior parte dos casos de cólicas estão relacionados com o manejo errôneo do animal, principalmente em relação a alimentação e restrição de exercício físico. Portanto, é de extrema importância informar aos proprietários desses animais sobre como deve ser feito o fornecimento de alimento tanto em quantidade como em qualidade, e sobre como a prática de atividade física pode evitar o desenvolvimento de distúrbios gastrointestinais.

Palavras-chave: Abdômen agudo. Cavalos. Exercício físico. Nutrição.

INTRODUCTION

In Brazil, a total of 4,236,062 horses were counted, being considered the fourth country in the world in the population of this species, only behind the United States, China and Mexico (IBGE, 2017). Horses were once considered the main means of transporting cargo in times when motor vehicles did not exist (CINTRA, 2011). However, the tiredness and stress that these animals are subjected to due to intense training, result in unwanted situations, which can trigger certain pathological manifestations, such as colic (RESENDE, 2005). Horses are considered herbivorous, monogastric animals and have a high potential for selectivity when choosing their feed, based on a diet consisting of vegetables, predominantly sprouts, stems and leaves (SALTER, HUDSON, 1979; ELLIS, HILL, 2005). However, even with the majority of the diet of these animals being composed of vegetables, over time, the concentrate-based diet was included in the diet of the horses, considering it one of the risk factors for the development of colic (MOORE, 2005; BERMEJO *et al.*, 2008; LEHUBY, 2011; RADOSTITS *et al.*, 2012).

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According to Tinker *et al.* (1997), changes in diet and intake of concentrate can cause cases of acute abdomen. Another important cause in the development of this illness is housing. Animals subjected to physical exercise restriction, consequently the lack of access to paddocks are predisposed to develop some type of stereotypy, which, in turn, favors the development of colic (FARIAS, 2017).

Colic is defined by changes in the digestive system, which can be associated with several causes, such as excessive gas generation in the stomach, food fermentation, intestinal obstructions and sprains. These dysfunctions can lead to severe neuro-circulatory disorders (CAMPELO; PICCIRIN, 2008). Even with improvements in the living conditions of horses, with better deworming and feeding practices, colic is still a challenge that causes fear, stress and expense to horse owners (SINGER *et al.*, 2002). This disease is responsible for economic losses related to high treatment costs, intervals with absence from participation in tests, which can lead to death (REED; BAYLE, 2000; THOMASSIAN, 2005).

Studies report that 4% of horses have a colic condition per year and that about 7% to 10% need surgical intervention (COOK; HASSEL, 2014). According to Laranjeira and Almeida (2009), animals that have had colic at some point in their lives are considered more susceptible to being affected again, this is due to possible sequelae.

The research highlights its relevance in order to contribute to the academic and social environment in terms of the impacts that this syndrome can generate on the breeders of the equine species. Therefore, this review aims to discuss the influence of stabling and feeding on the emergence of colic syndrome in horses.

METHODOLOGY

The methodology used to carry out the research was the literature review due to its practicality in the search for reliable information about a particular theme.

The platforms used for writing this work were: Academic Google, Scielo, Pubmed, as well as books in the field of Veterinary Medicine. The researches were carried out through national and international articles without temporal criteria, but giving preference to articles published in the last ten years. Such research highlights its relevance in order to contribute to the academic and social environment due to the impacts that this syndrome can generate on the breeders of the equine species.

The terms used to search for articles to carry out the work were: Acute abdomen. Horses. Physical exercise. Nutrition.

DEVELOPMENT

Anatomy and physiology of the digestive tract in horses

Horses are considered monogastric animals, they have the ability to select the food ingested through senses such as smell, vision, taste, lip mobility and sensitivity, which makes them an animal with high selective potential when choosing nutrients in the act of apprehension and cutting, performed by the incisor teeth, at the time of grazing (QUEIROZ, 2019).

The ingestion of water is done through the suction movement, the lips make an opening with the help of the tongue and the pharynx performs movements similar to a pump. With its high degree of mobility, the tongue is a muscular organ covered by papillae (CUNNINGHAM; KLEIN, 2008). According to Peiró and Mendes (2004), particularities of the digestive system of these animals, such as the inability to regurgitate caused by the well-developed musculature of the cardia, the absence of the vomiting center in the nervous system, the small capacity of the stomach volume, and even the long associated mesentery to the jejunum, factors are considered favorable to torsions, simple obstructions, and also, it is important to emphasize the esophagus-gastric junction, which favors the passage of gases and food in a unidirectional direction (ABUTARBUSH *et al.*, 2005).

Horses are considered monogastric animals, have a narrowing of the lumen diameter, as the transition to the smaller colon and pelvic flexure predisposes the accumulation of food in these regions, in addition to having a fragile rectal mucosa, which favors ruptures. The stomach of horses is shaped similar to a bean grain, has a storage capacity of 17 liters, however, this amount can be increased slightly to adapt to the regime, and can fill up to 2/3 of its size (CUNNINGHAM; KLEIN, 2008).

There are other peculiarities that can be found in the gastrointestinal tract of horses, such as fermentation in the hindgut, which is usually sensitive to intestinal illnesses; thus, pathologies associated with feeding are constantly studied (ERICSSON *et al.*, 2016).

According to Auer and Stick (2012), the second most frequent cause of colic is large colon compaction, which, in turn, is considered a simple obstruction. The simple obstruction of the intestinal tract is characterized as an obstruction without vascular compromise, that is, without interruption of the blood flow in that region, being the compactations an example of this disease, very present in the equine clinic (CÂMARA *et al.*, 2008). As reported by Ferreira *et al.* (2008), although compactations occur more commonly in the pelvic flexure region, they can be diagnosed in any part of the gastrointestinal system, two other frequently affected sites are the cecum and right dorsal colon (WHITE; DABAREINER, 1997).

The small intestine of these animals is 20 meters long, and its portions are called the duodenum, jejunum and ileum. The mucosa has epithelial cells that present microvilli responsible for increasing the intestinal absorption capacity (FRAPE, 2008). Horses have an absence of gallbladder which causes a constant release of bile, for this reason, together with the habits of prehistoric horses, the animal tends to feed at all times. The production of the pancreas occurs uninterruptedly, however, it presents low production of enzymes and a large amount of alkalis and bicarbonate, which in turn act in the neutralization of acids produced by the colon (HILLEBRAND; DRITTRICH, 2015).

The large intestine in horses is the most important part of the entire digestive system, is about 7 meters long and is divided into the cecum, colon and rectum. In it there are microorganisms similar to those present in the rumen, these are responsible for the fermentation of foods that were not absorbed in the small intestine (FRAPE, 2008). According to Dukes and Reece (2017), horses are animals capable of fermenting cellulose and hemicellulose in the cecum and ascending colon regions, converting these particles into volatile fatty acids. The three places where this fermentation takes place are exclusively in the cecum, ventral colon and dorsal colon.

Food

Generally, the occurrence of colic is closely linked to the ingestion of low quality food, especially during the driest periods of the year (PESSOA *et al.*, 2012). So, providing high quality foliage is recommended regardless of the season, in order to meet the animal's needs and avoid unwanted occurrences (DITTRICH *et al.*, 2010).

Low quality hays are less digestible and if they are ingested in abrupt food changes, they can lead to changes in the large intestine, more precisely in the colon, altering the microbiota and pH (COHEN; GIBBS; WOODS, 1999). The horse's usual nutrition consists of pastures, which in turn are considered the ideal food for the digestion process in the anatomy of the species' digestive system in its physiological state (THOMASSIAN, 2005).

However, nowadays, the nutrition of these animals has been intensely modified, being composed of high concentrations of starch, which from time to time undergoes sudden change, which leads to disturbances in the animal's microbiota triggering colic, ie, feeding this one is totally contrary to that of the equine ancestors (DURHAM, 2009).

The costliest result of this nutritional modification is the increase in diseases of the digestive system, characterized in most cases in colic syndrome (THOMASSIAN, 2005). Horse feeding requires careful selection, especially in forages that are capable of causing serious health problems if administered incorrectly (AMORIM *et al.*, 2017).

The supply of large amounts of concentrate favors the occurrence of colic, this occurs because the grain contains the presence of carbohydrates, which in turn is responsible for causing excessive fermentation in the digestive tract (WHITE, 1995).

According to Thomassian (2005), it is believed that the large amount of concentrated food offered in a few daily meals is closely related to the development of colic and that about 60% of these syndromes are caused by gross errors in the feeding management of animals. The correct way to offer this food to the horse is to divide it into at least three meals a day, in order to reduce gastric overload. According to Durham (2009), make the animal perform a slow ingestion, maintaining the constancy of diet with fiber and low starch content, in order to maintain the fermentative stability of fibers by microorganisms. The supply of hay should be made at least 1 hour before the animal ingests the concentrate, in order to encourage it to ingest the hay first. The ideal for an adult horse is to ingest a maximum of 3kg of concentrate per day (SANFORD; CARTOONIST, 2009).

According to Cintra (2016), the feed offered to horses can be classified into three categories: forage -grasses and legumes; forages - pastures, silage, pre-dried and hay; and concentrates, which are foods with high energy content composed predominantly of grains and cereals.

According to Silva, Unanian and Esteves (1998), it is recommended that horses ingest sufficient amounts of forage to reduce digestive disorders often attributed to feeding with a high amount of concentrate. It is also recommended that the animals be fed with a forage dry matter content of at least 1% of live weight per day. Excess fiber in the diet is not recommended as it can trigger gastrointestinal disturbances, although it is also reported that the amount less than required by the animal's metabolism can also cause unexpected problems. The recommended level of fiber to be included in the horse's diet varies between 13 and 16%.

Silva, Unanian and Esteves (1988) describe that equines usually graze, therefore, they ingest small amounts of forage. It is important to highlight that these animals are predisposed to medium height forages, among the most accepted forage grasses are included stolonifers or creepers such as kikuiu (*Pennisetum clandestinum*), coast-cross (*Cynodon dactylon*), pangola (*Digitaria decumbens*), and setaria (*Setaria anceps*). Horses are susceptible to large amounts of oxalate and nitrate in pastures, especially when they share the same environment with cattle, which, in turn, feed on pastures with a high amount of oxalate.

Among the main tropical forages indicated for horses include the ramirez (*Paspalum guenarum*) and the rhodes (*Chloris gayana*). These, in turn, have high nutritional value and are well

accepted by animals (SILVA; UNANIAN; ESTEVES, 1998). Other recommended pastures for equines are: Pensacola, Evergreen, Misiones, ryegrass, Timothy and White Clover (ANDRIGUETTO *et al.*, 1983).

Cultivars *Panicum maximum* have been reported to cause colic in horses (CERQUEIRA *et al.*, 2009; SCHONS *et al.*, 2012; DÓRIA *et al.*, 2015; SOUZA *et al.*, 2017). Acute intestinal bloat in horses grazing *Panicum maximum* cv. Tanzania, cv. Massai and cv. Mombasa, were reported in the northern region of the country, more precisely in the hot seasons of the year. However, the causes are still unknown, but it is believed that it is due to the large storage of non-fibrous carbohydrates along with grasses (SOUZA *et al.*, 2017).

According to Cerqueira *et al.* (2009), in Amazonia, the cultivars of *Panicum maximum*: Massai, Tânzania and Mombasa, mainly in the rainy seasons of the year, have been described as causing severe colic in horses, however, the cause of the toxicity has not been diagnosed. There are reports of cases of colic syndrome in horses also in the Rondônia region with the same cultivars of capineiras mentioned above (SOUZA *et al.*, 2017). Doria *et al.* (2015) also observed cases of colic by cultivars *Panicum maximum* in the Mato Grosso region.

Naviaux (1988) describes that among forages, alfalfa and oat hay and green pasture are the ones that most stand out in terms of the acceptability of horses. Alfalfa is considered an economical food, as the animal eats little and is satisfied, in addition to being extremely nutritious, rich in vitamins and high-quality proteins.

Oat in forage form is a satisfactory food for adult animals that do not practice any physical activity, but poor in protein and calcium, therefore, it is recommended to supply it together with a food that has these compounds in order to supply the needs of the animal. The green pasture is the most appetizing and rich in nutrients for the animals, a green pasture is not surpassed by any of the other forages, including flavor and nutrient source. However, as the pasture matures, its vitamin content as well as its flavor decrease, making it extremely important to rotate the pastures (NAVIAUX, 1988).

In relation to concentrates, it is worth mentioning salt, molasses, linseed, ground or mashed oats (NAVIAUX, 1988). Oats are the most commonly accepted by horses, followed by corn and barley. Rye and wheat, on the other hand, have low acceptance among horses, in addition to being only offered in a limited way, as their excess can trigger the formation of an insoluble mass in the stomach region (MEYER, 1995). Corn is commonly used because it is a grain with high energy content and its palatability capacity, however, when supplied in excess, it can develop laminitis, colic and diarrhea. This is because it has a low fiber content that can trigger cecal acidosis (LEWIS, 2000). Flaxseed can be used in three different ways: in the form of bran, grains and oil, it has a laxative character and is very well accepted by animals, due to its flavor (SANTOS *et al.*, 2012).

It is a great option for those who provide low quality hay, as it is a food rich in protein. Oats are considered a safe grain and a standard feed for equine lovers, as they contain nutrients needed to make up for grass deficiencies. Molasses is considered a great source of calcium, iron and carbohydrates, in addition to improving the taste of foods and providing high nutritional value, thus reducing high expenses with various foods (NAVIAUX, 1988).

According to Bird (2004), the feed must be purchased from renowned companies in the market in order to provide the animal with quality food. Its primary function is to correct and complement the needs of the bulky. They can be supplied in a few different ways, such as: extruded, multicomponent, laminated, pelleted and mash (CINTRA, 2011). However, the most recommended is pelleted due to its easy handling and storage (MEYER, 1995).

As mentioned by Queiroz (2019), colic caused by feeding is considered a recurrent and common factor in the equine clinic, and to reduce the damage caused by it, it is essential to obtain the help of a trained professional to perform the function of balancing and adapting the diets according to the demand and metabolism of each animal. The same author also reveals that it is possible to identify the food that causes the disease, and thus limit or even suspend its supply. According to Cintra (2016), about 98% of colic are related to irregular feeding management, and the chances of an

animal that lives on the open for most of the day feeding with quality roughage to develop this disease is minimal, approaching of zero.

It is worth noting that high quality feed, properly stored, is not the cause of colic as most people believe. What happens is that often the feed is offered moldy or out of date in large quantities and in few daily meals, thus favoring the predisposition to the syndrome. The basic diet of horses for maintenance is composed of water, roughage and mineral salt, regardless of the class to which they belong. The concentrate comes in as a nutritional supplement, as its function is to complement and correct the animal's needs, which the roughage cannot supply, especially when we think about energy. The roughage must make up at least 50% of the horse's diet in quantity of DM. This forage can be offered in the form of fresh grass, either pasture or in the trough, coming from grass, in the form of hay, grasses or legumes, in the form of silage, haylage or even, in the form of pre-dried (CINTRA, 2016).

In order for the horse to be fed correctly, it is necessary to understand the nutritional and energy needs of each category, in addition to studying how much energy this animal spends during its daily routine, for example, the metabolism of a horse that does not perform any type of physical activity is different from the metabolism of a horse athlete, which in turn needs a high level of energy, as an animal that is in constant training needs energy for maintenance and also for muscle work (MEYER, 1995).

Stable

With the passage of time and the growth of urban areas, rural spaces were being reduced and thus the need to relocate animals in smaller spaces, known as stables or stalls, emerged (REZENDE *et al.*, 2006). However, these changes are not considered favorable for horses, they often cause behavioral changes called stereotypies, including aerophagia, ingestion of litter or feces, digging the soil, and several others (BROM; FRASER, 2010). In addition to stereotypies, stabled animals are also more susceptible to the development of gastrointestinal changes, caused by lack of movement and inappropriate diet, in addition to dental changes that also contribute to the incidence of colic. (RIBEIRO *et al.*, 2009; PEREIRA, 2016).

One of the most important stereotypies developed by stabled animals is aerophagia. The general prevalence of aerophagia in horses ranges from 5.5 to 10.5%, and is closely related to the development of gaseous colic (DOYLE *et al.*, 2003). Aerophagia with support has been accepted as a behavior disorder in horses, becoming reported in the literature since 1578 (BORRONE; CANALI, 1993). The animal performs arching movements of the neck by contracting the cervical muscles of the ventral region of the neck, and with that, it positions the larynx rostrally, thus managing to ingest a large amount of air. The causes of this addiction are still considered unknown, however, it is believed that the problem is related to behavioral changes linked to lack of physical exercise, anxiety of animals kept in pens, isolation, low availability of bulky food and even hereditary factors (THOMASSIAN, 2005). Animals that are raised in extensive or semi-extensive systems will rarely perform aerophagy (THOMASSIAN, 2005).

The addiction to performing aerophagy is usually imitated by another horse, and once obtained, it is unlikely to be suppressed (MCGREEVY *et al.*, 1995). According to Thomassian (2005), over time, animals that have this habit are predisposed to develop anomalies, such as intense wear of the incisor teeth, gastritis, ulcers and gastric indigestion, hard palate hyperplasia, excessive flatulence, weight loss and hypertrophy of the ventral neck muscles.

According to Silva *et al.* (2014), horses housed in an extensive system have a shorter idle time when compared to animals that live in an intensive system, this happens because they spend more time chewing. In this sense, horses kept continuously in stables, with excessive intake or nutritional disorders related to concentrate/bulk, are more predisposed to the development of gastroenteric alterations when compared to horses raised in the semi-intensive or extensive system (THOMASSIAN, 2005).

However, it is possible to observe that the longer the period of permanence of horses in stables, the greater the threat of colic, especially if the food offered is not correctly balanced (COHEN, 2003; LARANJEIRA; ALMEIDA, 2009). According to Bermejo *et al.* (2008), when horses were still considered wild animals and lived predominantly on the loose, they grazed and fed at a rate of 60% of the day, while horses that live in stables feed for only 15% of the day, showing a serious change in the animal's life condition, leading it to develop behavioral changes such as anxiety, aggressiveness, discomfort and pain, thus predisposing to the development of the disease.

The absence of physical exercise together with the abrupt confinement of the animal favors the formation of compactations. Changes in feeding and the supply of inadequate amounts of water can lead to changes in the motility of the gastrointestinal tract of the horse, causing a decrease in the flow of the intake consumed. As stated in Dabareiner, White (1995) and White (1998), it is also believed that physical exercise favors the digestion of food, especially fibrous ones, since it acts by accelerating the metabolism in general, and, consequently, the gastrointestinal motility (FERREIRA *et al.*, 2009).

In fact, stalls are not considered the best environment for horses, but they are still used. Therefore, in order to reduce the problem caused by them, it has been indicated to carry out adequate management and installations within the recommended standards (BROOM; FRASER, 2010). These standards include a total area greater than 16 m², so that the animal can be move, touch, lie down and roll over (CINTRA, 2017). In addition to protecting the animal from inadequate temperatures, humidity and wind (MEYER, 1995), always aiming at the animal's well-being, with an emphasis on hygiene, comfort and safety, especially (BIRD, 2004).

Other measures that should be taken to improve the animal's quality of life include a more diversified diet with various forage species, interaction with other animals and the possibility of grazing in an outdoor area at certain times of the day (AFONSO, 2010). The bedding to be used in the pen can be composed of wood shavings, sawdust, peat or straw and its purpose is to fix or absorb the animal's excreta, protect it against mechanical aggressions and cause thermal insulation. The troughs, where the concentrated foods are offered, must be 75 cm long, 35 cm wide and 20 cm deep, with rounded edges in order to prevent accidents and facilitate cleaning. Drinkers must be 60 cm deep and the most suitable of all is the automatic drinker without a lid, which induces greater water intake. The water offered to the horse must not have additional tastes, in addition to being fresh, the temperature can vary between 9 to 12 °C (MEYER, 1995). The ingestion of water by the animal must be carried out before ingestion of concentrate and after ingestion of forages (ANDRIGUETTO *et al.*, 1983).

Changing the environment of an animal that lives in a stable to an extensive system and vice versa must be done slowly and gradually in order to avoid possible complications, this is because there are large differences in the composition of the food present in each habitat, the foods offered in the bay are poor in protein and water and rich in crude fiber, whereas the foods found in the extensive system are poor in crude fiber and rich in water and protein (MEYER, 1995).

Diagnosis

A well-done anamnesis is essential in the evaluation of the animal with colic and also collaborates in the choice of auxiliary diagnostic methods to obtain a reliable treatment (AUER; STICK, 2012). Any or all information provided by the owner or by those who follow the animal's routine is extremely important for the individual's framework. Data obtained in the anamnesis can tell a lot about the patient's clinical condition and even lead to the reason that triggered the disease (FRANCELINO *et al.*, 2015; KELLER, 2015).

The observation of equine behavior is essential for diagnosing equine colic, knowing that some clinical signs present are considered pathognomonic of this disease, being indicative of severe pain, such as lying down and rolling over, playing on the ground, walking difficulties, frequently looking at the flank, intense sweating, kicking the abdominal region, muscle fasciculations, tenesmus and digging movements (LARANJEIRA; ALMEIDA, 2009; MARSHALL; BLIKSLAGER, 2012).

Direct clinical examination as well as specific clinical examination of the gastrointestinal tract are essential to help diagnose the cause, since the acute abdomen is a multifactorial disease with unique clinical signs. There are several tests to be performed, including cardiac auscultation, mucosal staining, capillary filling time (CPT), rectal temperature, gastrointestinal motility, percussion, rectal palpation, respiratory rate assessment, passage of a nasogastric tube are also fundamental for the assessment of the patient (PEDROSA, 2008; COOK; HASSEL, 2014;).

According to Ashdown and Done (2012), there are several methods of auxiliary exams used to obtain the diagnosis of colic. Endoscopy is more used when there is suspicion of involvement of the stomach region, more precisely considering gastric ulcerations. Radiographic examination is more often performed in young animals, up to three years old. Ultrasonography, on the other hand, is indicated in cases of intussusception and for the observation of displacement of intestinal loops, more precisely those of the colon (ASHDOW; DONE, 2012).

The techniques used as the last choice for the diagnosis of this syndrome are exploratory laparotomy and laparoscopy (ASHDOW; DONE, 2012). Blood tests and abdominocentesis are also methods commonly used by veterinarians (COOK; HASSEL, 2014).

Treatment

According to Ashdown and Done (2012), it is extremely common for the veterinarian to spend a great part of his time attending medical and surgical emergencies due to problems in the abdominal region of horses. The colic syndrome is the main illness that demands the services of the veterinarian, being the most important clinical cause of death in this species. However, despite its severity, in 90% of cases, it can be reversed only with clinical treatment, which consists of relieving pain, preventing and/or correcting dehydration and offering supportive therapy to the animal.

According to Pedrosa (2008), the treatment of the disease varies according to the nature and severity of the case. In this sense, there are principles commonly used in the treatment of colic that aim to control the animal's pain, including the passage of a nasogastric tube in order to alleviate the stomach overload and prevent its rupture, correct the hydro-electrolyte and acidic balances. base through fluid replacement, analgesia and sedation, and administration of laxatives for gastrointestinal lubrication in cases of impaction.

When thinking about pain control, recommended analgesics are dipyrone (25 mg/kg), phenylbutazone (4-8 mg/kg), flunixin meglumine (1.1 mg/kg) and ketoprofen (2.2 mg/kg) (PEDROSA, 2008). However, the analgesic of choice for pain management in cases of colic is flunixin meglumine, which must be administered intravenously. This medication is considered the most effective in combating visceral pain (PEDROSA, 2008, WHITE; SEHAN, 2009). In high doses of 1.1 mg/Kg IV or IM, xylazine is considered an exceptional drug to control colic pain and has an action of up to 45 minutes. Detomidine, when compared to xylazine, is more efficient due to its longer action time, reaching up to 90 minutes. When the animal presents very severe pain, good sedation and analgesia is performed when we associate an alpha-2 adrenergic with an opioid, a commonly used association is that of xylazine (0.2-0.4 mg/kg) to butorphanol (0.02-0.1 mg/kg). In cases of spasmodic colic, the use of a spasmolytic is recommended, a well-known and widely used one is scopolamine butylbromide (buscopan), which has been used as a spasmolytic of choice in several regions of the world (ROSE, HOGDSON, 1993; EDWARDS, 1998; BLOOD *et al.*, 2000).

The choice of fluid therapy and the administration rate vary according to the clinical symptoms presented by the animal, but the objective is always the same: to correct the hydro-electrolyte and acid-base balance, and also to correct dehydration (PEDROSA, 2008). In cases of total obstruction and presence of gastric reflux, the preferred route of administration is intravenous, whereas in cases of partial obstruction and absence of gastric reflux, enteral administration via a nasogastric tube can be used. The maximum tolerated capacity per hour by an adult horse varies between 6 to 8 liters (ROSE; HOGDSON, 1993; EDWARDS, 1998; BLOOD *et al.*, 2000). The

displacement of the material that originates the compactions or obstructions is caused by a combination of fluid therapy and drugs with laxative functions (PEDROSA, 2008).

Liquid paraffin, commercially known as mineral oil, is the most used laxative in the routine of caring for horses, and must be administered orally through a nasogastric tube. This agent, through its ability to lubricate and reduce water absorption through the intestine, makes it easier for the contents of the intestinal lumen to remain moist, thus facilitating its exit from the intestinal compartment. However, this medication technique becomes restricted to treatments for moderate colic (ROSE; HODGSON, 1993). According to Rose and Hodgson (1993), the use of DMSO in horses with ischemic conditions and endotoxemia has increased the survival rate when compared to untreated animals. This agent is a solvent with an anti-inflammatory effect and has considerable tissue penetration capacity.

In view of the colic condition that veterinarians who are specialists in the field commonly face on a daily basis, it is considered an obligation to abruptly and efficiently choose the appropriate therapy to resolve the scenario in which the animal finds itself, whether in the medical clinic or in the surgical clinic (AMARAL; FROES, 2014).

CONCLUSION

In this order of considerations, it was possible to conclude that among the other predisposing factors to the development of colic, stabling and feeding stand out, this is because there are large numbers of animals that develop the disease due to mishandling of the food provided and lack of physical exercises.

Finally, it is up to the professional in the area to inform the owners about the importance of a balanced diet and with good quality food divided into three or more meals a day in order to reduce gastric overload and idle time, and also, it is noteworthy that for the animal to have a healthy diet, grain intake must be balanced and quality roughage intake increased. In addition, explaining the harm that an animal deprived of liberty can present is extremely important. If the animal cannot live in an extensive system, it is essential to at least let it graze for a few hours during the day.

REFERENCES

ABUTARBUSH, S. M.; CARMALT, J. L.; SHOEMAKER, R. W. Causes of gastrointestinal colic in horses in western Canada: 604 cases (1992 to 2002). **The Canadian Veterinary Journal**, v. 46, n. 9, p. 800-805, 2005.

AFONSO, A. M. C. F. **Comportamento alimentar de equinos em treinamento submetidos a três manejos**. 2010. 77f. Dissertação (Mestrado em Ciências Veterinárias) - Universidade Federal do Paraná, Curitiba, 2010.

AMARAL, C. H.; FROES, T. R. Avaliação do trato gastrointestinal de equinos pela ultrassonografia transabdominal: nova abordagem. **Semina: Ciências Agrárias**, v. 35, n. 4, p. 1881-1894, 2014.

AMORIM, D. S. *et al.* Caracterização e restrições de forrageiras indicadas para as diferentes espécies de animais de produção – revisão. **Revista Eletrônica Científica da UERGS**, v. 3, n. 1, p. 215-237, 2017.

ANDRIGUETTO, J. M. *et al.* **Nutrição animal**. São Paulo: Nobel, 1983. 411p.

ASHDOWN, R. R.; DONE, S. H. **Atlas colorido de anatomia veterinária de equinos**. 2. ed. Rio de Janeiro: Elsevier, 2012. 360 p.

- AUER, J. A.; STICK, J. A. **Equine Surgery**. 4. ed. Philadelphia: Ed. Saunders Company, cp. 33, p. 402-407, 2012.
- BORRONI, A.; CANALI, E. Behavioral problems in Thoroughbred horses reared in Italy. In: PROCEEDINGS OF THE 26TH CONGRESS OF APPLIED ETHOLOGY. **Anais...** p. 43-46, 1993.
- BERMEJO, V. J. *et al.* Abdômen agudo equino (síndrome cólica). **Revista Científica Eletrônica de Medicina Veterinária**, v. 6, n. 10, 2008.
- BIRD, J. **Cuidado natural del caballo: Um enfoque natural para su óptimo estado de salud, desarrollo y rendimiento**. 1. ed. Barcelona: Acanto. 2004. 206 p.
- BROOM, D. M.; FRASER, A. F. **Comportamento e bem-estar de animais domésticos**. 4. ed. Barueri: Manole, 2010. 438 p.
- BLOOD, D. C. *et al.*, Diseases of the alimentary tract: Diseases of the non-ruminant stomach and intestines. In: RADOSTITIS, O. M. *et al.* **A textbook of the diseases of cattle, sheep, pigs, goats and horses**. 9. ed. Philadelphia: W.B. Saunders Company Ltd, 2000. p. 197-209.
- CÂMARA, A. C. L. *et al.* Compactação seguida de ruptura de ceco em equino - relato de caso. **Acta Veterinaria Brasilica**, v. 2, n. 3, p. 93-96, 2008.
- CAMPELO, J.; PICCININ, A. Cólica Equina. **Revista Científica Eletrônica de Medicina Veterinária**, v. 6, n. 10, 2008.
- CERQUEIRA, V. D. *et al.* Colic caused by *Panicum maximum* toxicosis in equidae in northern Brazil. **Journal of Veterinary Diagnostic Investigation**, v. 21, n. 6, p. 882-888, 2009.
- CINTRA, A. G. **Alimentação equina: nutrição, saúde e bem-estar**. 1. ed. Rio de Janeiro: Roca, 2016. 354p.
- CINTRA, A. G. **O Cavalo: características, manejo e alimentação**. 1. ed. São Paulo: Roca, 2011. 384p.
- COHEN, N. D. Management factors associated with colic. In: **Current Therapy in Equine Medicine**. 5. ed. Elsevier, 2003.
- COHEN, N. D.; GIBBS, P. G.; WOODS, A. M. Dietary and other management factors associated edwith colic in horses. **Journal of the American Veterinary Medical Association**. v. 215, n. 1, p. 53-60, 1999.
- COOK, V. L.; HASSEL, D. M. Evaluation of the colic in horses: decision for referral. **Veterinary Clinical Equine**, v. 30, n. 2, p. 383-398, 2014.
- CUNNINGHAM, J. G.; KLEIN, B. G. **Tratado de fisiologia veterinária**. 4. ed. Rio de Janeiro: Saunders, 2008. 728p.
- DABAREINER, R. M.; WHITE, N. A. Large colon impaction in horses: 147 cases (1985-1991). **Journal of the American Veterinary Medical Association**, v. 206, n. 5, p. 679-685, 1995.

DRITTRICH, J. R. *et al.* Comportamento ingestivo de equinos e a relação com o aproveitamento das forragens e bem-estar dos animais. **Revista Brasileira de Zootecnia**, v. 39, n. Supl. Esp., p. 130-137, 2010.

DÓRIA, R. G. S. *et al.* Avaliação clínica e da evolução dos casos de cólica associados ao *Panicum maximum* no estado de Mato Grosso, Brasil. **Brazilian Journal of Veterinary Medicine**, v. 37, n. 4, p. 303-308, 2015.

DOYLE, A. J. *et al.* Cribbing as a risk factor for entrapment of the small intestine in the epiploic foramen. In: PROCEEDINGS OF THE 49TH ANNUAL CONVENTION OF THE AMERICAN ASSOCIATION OF EQUINE PRACTITIONERS. New Orleans. **Anais...** New Orleans, 2003, p. 371-372.

DURHAM, A. E. The role of nutrition in colic. **Veterinary Clinics of North America: Equine Practice**, v. 25, n. 1, p. 67-78, 2009.

DUKES, H. H.; REECE, W. O. **Fisiologia dos animais domésticos**. 13. ed. Rio de Janeiro: Guanabara Koogan, 2017. 740p.

EDWARDS, G. B. Gastroenterology 1. Colic. In: LOVE, S.; MAIR, T.; SCHUMACHER, J.; WATSON, E. (Eds.). **Equine Medicine, Surgery and Reproduction**. Philadelphia: W.B. Saunders Company Ltd, 1998. p. 20-54.

ELLIS, A. D.; HILL, J. **Nutritional physiology of the horse**. Nottingham: Nottingham University Press, 2005. 361p.

ERICSSON, A. C. *et al.* Microbiological map of the healthy equine gastrointestinal tract. **PLoS One**, v. 11, n. 11, p. 1-17, 2016.

FARIAS, M. L. V. **Comportamento de equinos estabulados submetidos a diferentes quantidades de atividade física**. 2017. 18f. Trabalho de Conclusão de Curso (Graduação em Zootecnia) - Universidade Federal de Uberlândia, Uberlândia, 2017.

FERREIRA, C. *et al.*, Cólicas por compactação em equinos: etiopatogenia, diagnóstico e tratamento. **Acta Veterinaria Brasilica**, v. 3, n. 3, p. 117-126, 2009.

FERREIRA, C., *et al.* Compactações do trato gastrointestinal em equinos: achados clínicos de 64 casos. In: VIII CONFERÊNCIA SUL-AMERICANA DE MEDICINA VETERINÁRIA, 2008, Rio de Janeiro. **Anais...** CD-ROM, Rio de Janeiro, 2008.

FRANCELLINO, J. O. R. *et al.* Pronto atendimento de síndrome cólica em equinos - revisão de literatura. **Revista Científica de Medicina Veterinária**, Ano XIII, n. 25, p. 1-17, 2015.

FRAPE, D. L. **Nutrição e alimentação de equinos**. 3. ed. São Paulo: Roca. 2008. 616p.

HILLEBRAN, R. S.; DITTRICH, J. R. Anatomia e fisiologia do aparelho digestório de equinos aplicadas ao manejo alimentar. **Revista Acadêmica de Ciência Equina**, v. 1, n. 1, p. 16-22, 2015.

HUDSON, J. M. *et al.* Feeding practices associated with colic in horses. **Journal of the American Veterinary Medical Association**, v. 219, n. 10, p. 1419-1425, 2001.

- INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Efetivo dos Rebanhos**. Sistema IBGE Censo Agro, 2017.
- KELLER, S. D. **Equine Colic Management**. Australian Veterinary Association, 2015.
- KÖNIG, H. E.; LIEBICH, H. G. **Anatomia dos animais domésticos**. 4 ed. Porto Alegre: Artmed, 2011. 788p.
- LARANJEIRA, P. V. E. H.; ALMEIDA, F. Q. Síndrome cólica em equinos: ocorrência e fatores de risco. **Revista de Ciências da Vida**, v. 28, n. 1, p. 64-78, 2009.
- LEHUBY, S. **Relevância do Exame Clínico Inicial de Cavalos com Cólica no estabelecimento de um Diagnóstico Médico e na determinação da Opção Terapêutica**. 2011. 127f. Dissertação (Mestrado Integrado em Medicina Veterinária) – Universidade Técnica de Lisboa, Lisboa, 2011.
- LEWIS, L. D. **Nutrição clínica equina: alimentação e cuidados**. 1. ed. São Paulo: Roca, 2000. 710p.
- NAVIAUX, J. L. **Cavalos na saúde e na doença**. 2 ed. São Paulo: Roca, 1988. 285p.
- MCGREEVY, P. D. *et al.* Management factors associated with stereotypic and redirected behavior in the Thoroughbred horse. **Equine Veterinary Journal**, v. 27, n. 2, p. 86-91, 1995.
- MARSHALL, J. F.; BLIKSLAGER, A. T. Colic: diagnosis, surgical decision, and preoperative management. In: AUER, J. A.; STICK, J. A. **Equine Surgery**. 4. ed. St. Louis: Elsevier, 2012. 402 p.
- MEYER, H. **Alimentação de cavalos**. 2. ed. São Paulo: Varela, 1995, 300p.
- MOORE, R. M. **Treatment of luminal obstructions of the large and small colon in horses**. American Association of Equine Practitioners – AAEP: Quebec, 2005.
- PEDROSA, A. R. P. A. A. **Cólica em equinos: tratamento médico vs cirúrgico – critérios de decisão**. 2008. 115f. Dissertação (Mestrado Integrado em Medicina Veterinária), Universidade Técnica de Lisboa, Lisboa, 2008.
- PEIRÓ, J. R.; MENDES, L. C. Semiologia do sistema digestório equino. In: FEITOSA, F. L. F. **Semiologia veterinária: a arte do diagnóstico**. 3. ed. São Paulo: Roca, 2004. p.139-175.
- PEREIRA, T. J. M. **Estereotípias orais em equino confinados: revisão bibliográfica**. 2016. 34f. Trabalho de Conclusão de Curso (Graduação em Zootecnia) - Universidade Federal do Maranhão, Chapadinha, 2016.
- PESSOA, A. F. A. *et al.* Abdômen agudo em equídeos no semiárido da região Nordeste do Brasil. **Pesquisa Veterinária Brasileira**, v. 32, n. 6, p. 503-509, 2012.
- QUEIROZ, D. L. **Influência da alimentação na causa da cólica equina**. 2019. 33f. Trabalho de Conclusão de Curso (Graduação em Zootecnia) - Instituto Federal Goiano, Ceres, 2019.

- RADOSTITS, O. M. *et al.* **Clínica veterinária: Um tratado de doenças dos bovinos, ovinos, suínos, caprinos e equinos**. 9. ed. Rio de Janeiro: Guanabara Koogan. 2012. 1772p.
- REED, S. M.; BAYLY, W. M. **Medicina interna equina**. 1. ed. Rio de Janeiro: Guanabara Koogan, 2000. 940p.
- REYNOLDS, J. A new look at fiber in horse feeds. **Equine nutrition in the 21st century**, 2007.
- REZENDE B. M. J. M. *et al.* Comportamento de cavalos da raça Bretã e Percheron estabeulados. **Ciência Animal Brasileira**, v. 7, n. 1, p. 17-25, 2006.
- RESENDE, A. M. Miosites no cavalo atleta. In: II SIMPÓSIO DO CAVALO ATLETA - IV SEMANA DO CAVALO, 2005, Belo Horizonte. **Anais...** Belo Horizonte: UFMG, 2005, p. 56-75.
- RIBEIRO, L. B. *et al.* Comportamento e distúrbios alimentares em equinos durante ensaio de metabolismo recebendo volumosos com diferente qualidade nutricional acrescido de probiótico (*Saccharomyces cerevisiae*). **Revista da Faculdade de Zootecnia, Veterinária e Agronomia**, v. 16, n. 1, p. 134-143. 2009.
- ROSE, R. J.; HODGSON, D. R. Alimentary system: examination and approach to treatment of the horse with abdominal pain colic. In: ROSE, R. J.; HOGDSON, D. R. **Manual of equine practice**, 2. ed. London: W.B. Saunders Company, 1993. 206-212 p.
- SANFORD, H. W.; CARTOONIST, U. **Animal nutrition: handbook**. 2. ed. Chiba. 2009. 548p.
- SANTOS, L. E. *et al.* Manejo nutricional e alimentar de equinos – Revisão. **Revista Eletrônica Nutritime**, v. 174, n. 9, p. 5, 2012.
- SALTER, R. E.; HUDSON, R. J. Feeding ecology of feral horses in western Aberta. **Journal of Range Management**, v. 32, n. 3, p. 221-225, 1979.
- SCHONS, S. V. *et al.* Intoxicações por plantas em ruminantes e equídeos na região central de Rondônia. **Ciência Rural**. v. 42, n. 7, p. 1257-1263, 2012.
- SOUZA, M. T. M. *et al.* Timpanismo gastrointestinal em equídeos alimentados com *Panicum maximum* com alto conteúdo de amido. **Pesquisa Veterinária Brasileira**, v. 37, n. 10, p. 1079-1084, 2017.
- SHIRAZI-BEECHEY, S. P. Interações moleculares em cólicas induzidas pela dieta no cavalo. **Equine Veterinary Journal**, v. 40, n. 4, p. 414-421, 2008.
- SINGER, E. R.; SMITH, M. A. Examination of the horse with colic: is it medical or surgical? **Equine Veterinary Education**, v. 14, n. 2, p. 87-96, 2002.
- SILVA, F. D. E. A.; UNANIAN, M. M.; ESTEVES, N. S. **Criação de Equinos: Manejo Reprodutivo e da Alimentação**. Brasília: Embrapa. 1998. 72 p.
- THOMASSIAN, A. **Enfermidades dos cavalos**. 4. ed. São Paulo: Livraria Varela. 2005. 573 p.
- TINKER, M. K. *et al.* Prospective study of equine colic risk factors. **Equine Veterinary Journal**, v. 29, n. 6, p. 454-458, 1997.

WHITE, N. A. Large colon impaction. **Equine Veterinary Education**, v. 10, n. 6, p. 291-293, 1998.

WHITE, N. A. Epidemiology of equine colic. In: ANAIS 2º CICLO INTERNACIONAL DE CÓLICA EQUINA, 1995, Jaboticabal. **Anais...** Jaboticabal, 1995, 1-9 p.

WHITE, N. A.; DABAREINER, R. M. Treatment of impaction colics. **Veterinary Clinics of North America: Equine Practice**, v. 13, p. 243-259, 1997.

WHITE, N. A.; SHEHAN, J. E. Treating colic. In: PROCEEDINGS OF THE 11TH ANNUAL RESORT SYMPOSIUM OF THE AMERICAN ASSOCIATION OF EQUINE PRACTITIONERS (AAEP), 79, 2009, Gold Coast. **Anais...** Gold Coast: AAEP, 2009, p. 317-328.