





## Diseases of the digestive system of agoutis (*Dasyprocta leporina*) raised in captivity in the Brazilian semiarid region<sup>1</sup>

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**ABSTRACT.-** Batista J.S., Teófilo T.S., Silva F.H.A., Felix N.S., Silva E.C.O., Araújo Júnior H.N., Oliveira R.E.M. & Oliveira M.F. 2022. **Diseases of the digestive system of agoutis (*Dasyprocta leporina*) raised in captivity in the Brazilian semiarid region.** *Pesquisa Veterinária Brasileira* 42:e06765, 2022. Universidade Federal Rural do Semi-Árido, BR-110 Km 47, Av. Francisco Mota s/n, Presidente Costa e Silva, Mossoró, RN 59625-900, Brazil. E-mail: [jaelsoares@hotmail.com](mailto:jaelsoares@hotmail.com)

The objective of this study was to describe the clinical and pathological aspects of diseases of the digestive system in agoutis (*Dasyprocta leporina* Linnaeus, 1758) diagnosed by the “Laboratório de Patologia Veterinária” (Veterinary Pathology Laboratory) of the “Universidade Federal Rural do Semi-Árido” (UFERSA), from January 2018 to February 2020. During the study period, necropsy and a survey of the clinical history of 27 agoutis were performed, 25.93% (7/27) of which were diagnosed with digestive system diseases. The percentages of digestive tract diseases among the diagnosed were: acute carbohydrate overload (11.12%), gastric ulcer (7.41%), gastric volvulus (3.70%), and intestinal volvulus (3.70%). Studies on the occurrence rate of these diseases, as well as the description of their clinical and anatomopathological aspects, may serve as a basis for guiding the appropriate management in the breeding of these animals.

INDEXING TERMS: Digestive system disorders, agoutis, *Dasyprocta leporina*, captivity, semiarid, Brazil, wild animals, necropsy.

**RESUMO.- [Doenças do sistema digestivo de cutias (*Dasyprocta leporina*) criadas em cativeiro na região semiárida brasileira.]** O objetivo deste estudo foi descrever os aspectos clínicos e patológicos das doenças do aparelho digestivo em cutias (*Dasyprocta leporina* Linnaeus, 1758) diagnosticadas pelo Laboratório de Patologia Veterinária da Universidade Federal Rural do Semiárido (UFERSA), de janeiro 2018 a fevereiro de 2020. Durante o período do estudo, foram realizadas necropsias e levantamento da história clínica de 27 cutias, sendo 25,93% (7/27) diagnosticadas com doenças do aparelho digestivo. Os percentuais de doenças do aparelho digestivo foram: sobrecarga aguda de carboidratos (11,12%), úlcera gástrica (7,41%), vólvulo gástrico (3,70%) e vólvulo intestinal (3,70%). Estudos sobre a taxa de ocorrência dessas doenças, bem como a descrição de seus aspectos clínicos e

anatomopatológicos, podem servir de base para orientar o manejo adequado na criação dessa espécie.

TERMOS DE INDEXAÇÃO: Distúrbios do sistema digestivo, cutias, *Dasyprocta leporina*, cativeiro, semiárido, Brasil, animais silvestres, necropsia.

### INTRODUCTION

Knowledge about the morphology of the gastrointestinal tract of wild animals has major implications for the development and adequacy of the diet, as well as for physiological, parasitological and pathological studies (Vidotti et al. 2007).

Infectious diseases, traumatic injuries, nutritional and metabolic diseases, and other morphological and functional changes can impair the success of the maintenance and reproduction of wild fauna in captivity, or populations in free life (Mangini et al. 2002).

In this context, the postmortem examination is primarily useful, as it is often the only diagnostic tool, being able to

<sup>1</sup> Received on May 2, 2021.

Accepted for publication on July 6, 2021.

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determine the natural history of a disease, its prevalence, predisposing factors, and provide subsidies for the development of preventive measures and control of diseases that affect wild animals (Batista et al. 2014). In addition, also contributes to the identification of risk factors for the main threats and the consequences of human activity on the environment and wildlife, providing information on the health of ecosystems and populations (Garcês et al. 2018).

The agouti (*Dasyprocta leporina* Linnaeus, 1758), species of this study, belongs to the order Rodentia, family Dasyproctidae, genus *Dasyprocta*. It is an important species of the Brazilian wild fauna, with great economic and zootechnical potential, with specific desirable characteristics for breeding in captivity (Bezerra et al. 2016).

Regarding the agouti digestive tract, it is known that the species has four tubuloacinar salivary glands, mostly mixed: parotid, mandibular, zygomatic and sublingual (Oliveira Júnior et al. 2016). Other organs described in agoutis were: tongue, teeth, esophagus, simple stomach, small intestine, cecum, colon, rectum and the glands of the anal sac with opening to the anus (Garcia et al. 2000). There are also studies on the morphophysiology of the cecum, as an important organ for the process of intestinal digestion and food fermentation by symbiosis with bacteria (Shinohara et al. 2016), such as: *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* spp., *Clostridium* spp. (Oliveira et al. 2009).

To add information about the different diseases that can affect agoutis raised in captivity in the semiarid region of northeastern Brazil, Batista et al. (2010) performed anatomopathological examinations in 32 agoutis and found the following percentages of diseases: perinatal death due to starvation/hypothermia complex (21.6%), obstructive urolithiasis (6.24%), dystocia (6.24%), obstruction of the cecum by sand (6.24%), intussusception (3.20%), fecaloma (3.20%), and esophageal obstruction (3.20%).

In this study, it was evident that diseases of the digestive system were important cause of death of agoutis submitted to necropsy (15.84%), which demonstrates the need for studies that describe the frequency and anatomopathological characteristics of diseases of the digestive tract in agoutis.

Thus, this study aimed to describe the clinical and pathological aspects of digestive system diseases in agoutis (*Dasyprocta leporina* Linnaeus, 1758) diagnosed by the "Laboratório de Patologia Veterinária" (Veterinary Pathology Laboratory) of the "Universidade Federal Rural do Semi-Árido" (UFERSA), from January 2018 to February 2020.

## MATERIALS AND METHODS

In the present study included 27 adults agouti (*Dasyprocta leporina* Linnaeus, 1758). The animals were kept from the "Centro de Multiplicação de Animais Silvestres" (CEMAS - Center for Multiplication of Wild Animals) of the "Universidade Federal Rural do Semi-Árido" (UFERSA), located in the municipality of Mossoró/RN, Brazil, registered as a scientific breeding site with the "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis" (IBAMA - Brazilian Institute for Management and Renewable Natural Resources) under number 14789-12.

The animals were fed grain corn, tubers such as potatoes, cassava, and regional fruits, commercial rabbit food, and water *ad libitum*. The general sanitary measures adopted consist of periodic removal of excreta, cleaning of feeders, and drinking fountains as well as

preventive deworming. Inspection of all animal lots is carried out daily, and when any change is identified, the animal is then subjected to clinical examination, in which body weight, rectal temperature, apparent mucosal aspects, degree of hydration, behavior, and general state. When necessary, the material is also collected for laboratory tests (blood count and serum biochemistry), in addition to the specific treatment of sick animals.

The agoutis died naturally and were referred to the "Laboratório de Patologia Veterinária" (Veterinary Pathology Laboratory) for anatomopathological examination from January 2018 to February 2020. The necropsy technique proposed by Vasconcelos (1996) was used, with an external examination of the animal, followed by the opening of the thoracic, abdominal, and cranial cavities, removal of the organs, and complete macroscopic study as well as photographic documentation of the significant findings. Fragments of various organs were collected and fixed in 10% formaldehyde, processed routinely for histology, embedded in paraffin, cut to 5- $\mu$ m thick, and stained with hematoxylin-eosin (HE), as described by Tolosa et al. (2003).

In the animals diagnosed with pathological alterations of the digestive tract, a survey of the data was carried out in the individual identification sheets in the herd, to obtain information related to the management of the animal, case history, age, sex, in addition to the clinical signs associated with digestive disorders as well as treatment protocols performed.

The statistical model used was the descriptive-analytical, with the determination of the absolute number of cases of diseases of the digestive system and the respective percentage values in terms of frequency of diagnosis.

This study was approved by the Ethics Committee on the Use of Animals (CEUA) of the UFERSA, under protocol number 23091.005467/2013-01.

## RESULTS

During the study period, necropsy on 27 agoutis was performed, with 25.93% (7/27) animals diagnosed with diseases affecting the digestive system. The acute carbohydrate overload occurred in 11.12% (3/27). The affected agoutis were adult, male agoutis that showed clinical signs of apathy, prostration, decreased food intake, goosebumps, yellowish watery diarrhea, severe abdominal distention, and muscle weakness. All animals died two days after the clinical signs started.

On necropsy, congested mucous membranes were observed, with evidence of dehydration, congestion, pulmonary edema, and hemorrhagic suffusions in the kidney and liver capsule, in addition to marked distention of the stomach. The stomach showed that the organ was full of food content, composed of a large amount of corn fragments and others similar to tubers, in the middle of a pasty, yellowish mass with a sweet odor (Fig.1). It was observed that the stomach mucosa was hemorrhagic, edematous, and easily detached. Histological examination of the stomach revealed necrosis of the lining epithelium and multifocal areas of separation of the epithelium from the lamina propria, in addition to the presence of polymorphonuclear infiltrate and hemorrhage.

Gastric ulcer was diagnosed in 7.41% (2/27) adult agoutis, one female, and one male. The female, presented with a retained placenta, in postpartum, that evolved to acute puerperal metritis and death two days after delivery. In this animal, during the exploration of internal organs, an ulcer was observed in the region of the stomach body, with a linear shape, measuring 3.1x0.5cm in diameter, with



a reddish color. Histological changes observed focal loss of mucous epithelial cells, infiltration of the lamina propria by mononuclear inflammatory cells.

The male had a clinical diagnosis of urolithiasis with lethargy, anorexia, hematuria, strangeness, and progressive weight loss. It was found that the animal presented blood count microcytic hypochromic anemia and increased serum levels of creatinine (2.5mg/dl) and urea (50mg/dl). The animal did not respond satisfactorily to the treatment and died, and was then referred for necropsy.

During necropsy, ulcerations in the oral cavity, marked pulmonary edema, hyperemia, and enlarged kidneys were found, in addition to the presence of a urolith based in the renal pelvis. In the stomach, the presence of pasty and dark red content of ammonia odor was observed, in addition to a deep, rounded ulcer with raised edges, hyperemic, measuring 1.0 to 0.8cm in diameter, located on the body of the stomach (Fig.2). The microscopic analysis of kidneys, revealed acute tubular injury, characterized by presence of degeneration and necrosis of epithelial cells. Other findings consisted of intratubular granular cylinders, hemorrhage, and multifocal mononuclear interstitial nephritis. In the fragments collected from the stomach ulcer, there was focal loss of mucosal

epithelial cells and infiltration of mononuclear inflammatory cells (Fig.3).

The gastric volvulus was diagnosed in 3.70% (1/27) of the cases. The affected animal was a male, that was found dead in the enclosure, with marked abdominal distension. At necropsy, it was found that the stomach was markedly dilated and rotated on its axial axis. The spleen was not in its normal anatomical location, being inserted in the smaller curvature, folded over itself, increased in size, and congestion (Fig.4). After opening the stomach, there was a large amount of gas and food content.

Intestinal volvulus was observed in 3.70% (1/27) of the cases. The diagnosis was made in an adult female agouti, that presented clinical signs of restlessness, anorexia, tenesmus, and signs of abdominal discomfort with abdominal contortions. Upon physical examination, the animal presented with moderate dehydration, congested mucous membranes, body temperature of 39.1°C, in addition to marked distension and pain abdominal at the time of palpation. Treatment with antibiotic therapy was established, but the animal did not respond to treatment. The clinical condition worsened with manifestations of apathy, weakness, prostration, and after eight hours of clinical evolution, the animal died. In that animal, an

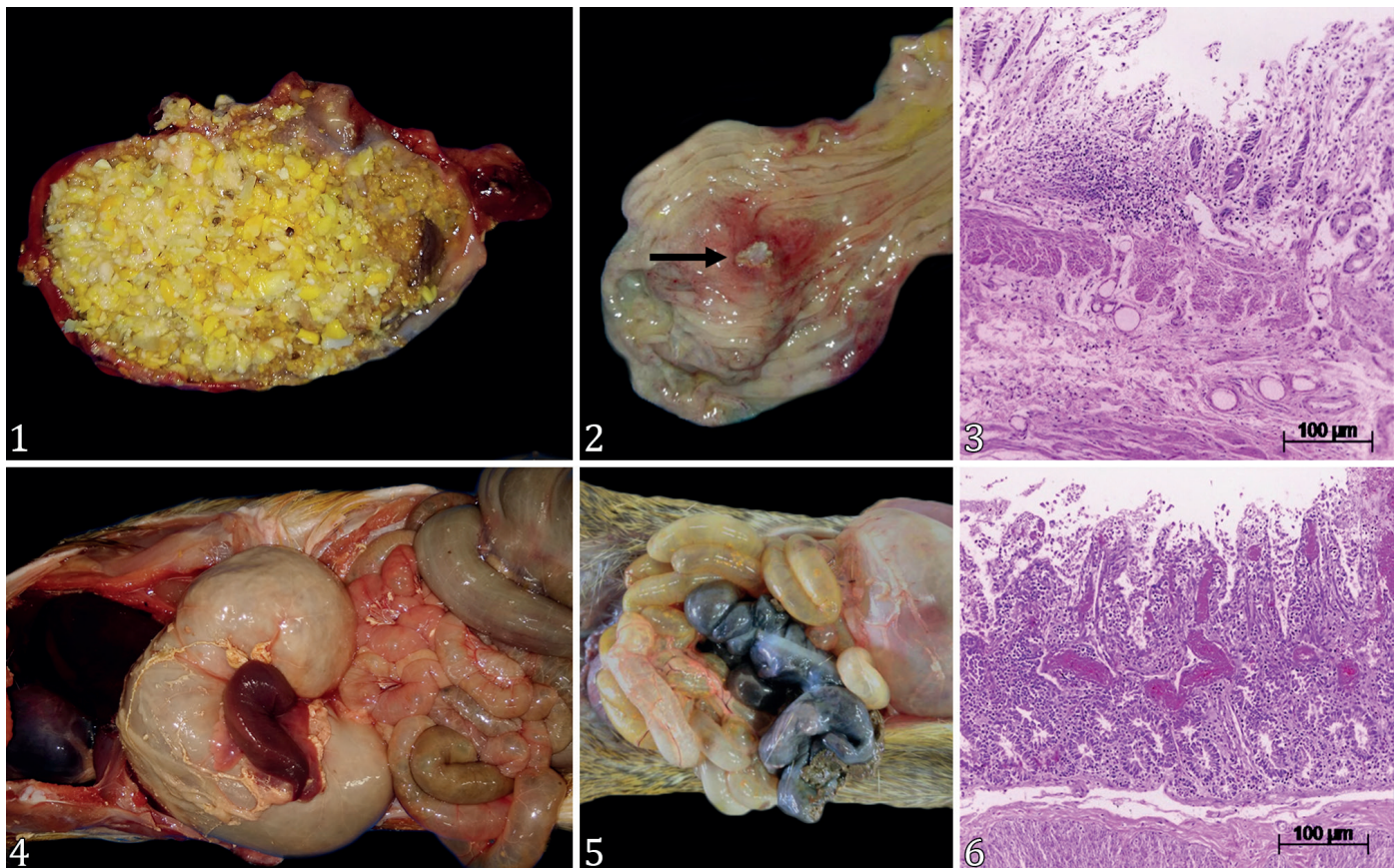


Fig.1-6. Diseases of digestive system of agoutis (*Dasyprocta leporina* Linnaeus, 1758). (1) Acute carbohydrate overload in agoutis. Stomach full of food content with a predominance of corn kernels and tuber-like fragments. (2) Gastric ulcer. A region of the stomach body shows a deep lesion, with hyperemic halo. (3) Photomicrography of the stomach with gastric ulcer. Focal loss of mucosal epithelial cells, infiltration of mononuclear inflammatory cells is observed. HE, obj.20x. (4) Gastric volvulus. Stomach was dilated, rotated on its axial axis and spleen inserted in the lower curvature, folded over, enlarged, and congested. (5) Intestinal volvulus. Twisted colon with bluish gray color and gas distension of intestinal loops. (6) Photomicrography of the intestine with colon volvulus. Necrosis of the intestinal epithelium, presence of cellular debris mixed with fibrin, inflammatory cells and vascular congestion are observed. HE, obj.20x.

intestinal volvulus was found, characterized macroscopically by complete rotation of the colon around its mesenteric base. The twisted colon was greyish in color and other intestinal loops were distended by gas (Fig.5). Histological examination of the intestine revealed necrosis of the intestinal epithelium, presence of cellular debris mixed with fibrin, inflammatory cells and vascular congestion (Fig.6).

## DISCUSSION

Diseases of the digestive tract represent an important cause of mortality in agoutis raised in captivity submitted to necropsy, representing 15.84% of the total diagnosed diseases (Batista et al. 2010). In the present study, 25.93% distributed in four distinct diseases that affected the digestive tract of agoutis were diagnosed, thus reinforcing the importance of these diseases as a cause of death in this species.

The acute carbohydrate overload represented the highest frequency of alterations observed in the digestive tract of agoutis. The acute carbohydrate overload occurs in animals that have not been adapted to the food provided, usually when there is a change in diet or animals that are already adapted, but that ingest lots of carbohydrates abruptly (Quevedo et al. 2015). In the case under study, there was no change in the diet provided to agoutis as well as an increase in the amount of carbohydrate provided. It is possible to suggest that acute carbohydrate overload occurred in dominant animals in the enclosure, which allowed them to eat large amounts of food, such as corn and tubers, which ferment quickly.

The anatomopathological alterations seen in an agouti diagnosed with urolithiasis are in line with those described in the literature, in cases of uremia. We can infer that the ulcer observed in the stomach was a manifestation of extra-renal lesions of uremia and can, therefore, be classified as uremic gastropathy. Uremic gastropathy is a lesion resulting from prolonged azotemia, which occurs due to the retention of biochemically active compounds (uremic toxins), which, under normal conditions, are metabolized and excreted by the kidneys (Silveira et al. 2015). The presence of gastric ulcer was found in an agouti diagnosed with acute puerperal metritis. Because the animal did not have a history of clinical changes related to gastric ulcer, it was possible to infer that it was an incidental necropsy finding.

In a male breeding animal that presented intense abdominal distension, anatomopathological alterations were observed, similar to those described in the literature and compatible with gastric volvulus dilation. Gastric volvulus dilation occurs when the stomach distends as gas accumulate in the lumen as a consequence of fermentation of food content, obstruction, or delayed gastric emptying. The distended stomach, associated with peristaltic movements, can twist on itself, blocking blood flow, causing acute alterations and potentially lethal (Bhatia et al. 2010).

The composition of the diet and eating habits are identified as possible risk factors for the occurrence of gastric volvulus dilation (Silva et al. 2012). It is important to highlight that gastric volvulus dilation occurred in an isolated case, affecting only the breeding animal, which therefore presents a dominance relationship concerning the animals in the group, which suggests that the animal ingested a large amount of fermentable food abruptly, a fact that may have contributed to the occurrence of gastric volvulus dilation.

The intestinal volvulus was identified as the cause of intestinal obstruction with acute and fatal evolution. The twisting of a bowel loop around its mesenteric attachment point, which is also accompanied by twisting and obstruction of the mesenteric artery, in addition to its branches, results in the impeding of blood flow, intestinal anoxia, circulatory shock, sepsis, and endotoxemia, resulting in death (Fossum 2014). They are described in the literature the predisposing factors for the occurrence of intestinal volvulus are: abnormal intestinal content, presence of a foreign body in the intestine, neoplasms, or major nematode infections, especially ascarids (Zachary & McGavin 2012). However, none of the aforementioned factors were observed at necropsy, so the cause of the intestinal volvulus diagnosed in this agouti could not be established.

## CONCLUSIONS

The finding of macroscopic and histological lesions allowed the diagnosis of acute carbohydrate overload, gastric ulcer, gastric volvulus, and intestinal volvulus as the main diseases that affected the digestive system of agoutis.

Studies on the frequency of occurrence of these diseases, as well as the description of their clinical and anatomopathological aspects, may serve as a basis for guiding the proper management in the creation of this species.

**Conflict of interest statement.**- The authors have no competing interests.

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