

ORIGINAL ARTICLE

## Vagal indigestion in Zebu cattle in Brazil

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**ABSTRACT:** Vagal indigestion or “Hoflund Syndrome” is a disease characterized by the dysfunction of the tenth pair of cranial nerves that causes changes in stomach motility. In the present study, the clinic-pathological tests were performed on three pasture-raised Zebu cattle suspected of vagal indigestion. The epidemiological data were obtained on three properties; two of them located in the northeastern part of Pará state, and the other located in Açailândia municipality in Maranhão state. The predominant clinical symptoms were apathy, dehydration, dry feces or diarrhea, changes in rumen motility, and bilateral distension (both the dorsal and ventral region were distended on the left side, but only the ventral region was distended on the right side). A positive atropine test confirmed the clinical suspicion of vagal indigestion in the three cases. Necropsies on two of the animals confirmed that an adhesion of the reticulum to the diaphragm was the cause of the vagal nerve damage observed.

**Key words:** Vagal lesion, Hoflund syndrome, Pará, Maranhão.

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### Indigestión vagal en el ganado Cebú en Brasil

**RESUMEN:** La indigestión vagal, o "Síndrome Hoflund", es una enfermedad que se caracteriza por la disfunción del décimo par de nervios craneales que causa cambios en la motilidad del estómago. En el presente estudio se realizaron exámenes clínico-patológicos en tres bovinos Cebú criados con pasto y que eran sospechosos de padecer indigestión vagal. Se obtuvieron los datos epidemiológicos de tres propiedades: dos de ellos estaban ubicadas en la parte noreste del estado de Pará y la otra se encuentra en el municipio Açailândia, en el estado de Maranhão. Los síntomas clínicos predominantes fueron apatía, deshidratación, heces secas o diarrea, cambios en la motilidad del rumen y distensión bilateral (la región dorsal y la región ventral se distendieron en el lado izquierdo, pero solo la región ventral estaba distendida en el lado derecho). Una prueba positiva de atropina confirmó la sospecha clínica de la indigestión vagal en los tres casos. Las necropsias de dos de los animales confirmaron que la causa del daño al nervio vagal observado fue una adhesión del retículo al diafragma.

**Palabras clave:** Lesión vagal, síndrome Hoflund, Pará, Maranhão.

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### INTRODUCTION

Vagal indigestion in cattle was first described in 1940 by Hoflund. It is characterized by a dysfunction in the tenth pair of cranial nerves that leads to changes in forestomach motility (1, 2). The vagal nerve is not only found in the head and neck; it also extends to the

thoracic and abdominal cavities, where it branches and forms a visceral plexus. There are two main types of vagal indigestion: a proximal functional stenosis between the reticulum and the omasum, and a distal functional stenosis between the abomasum and the duodenum (3).

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The vagal indigestion pathogenesis in cattle is not well defined, and the causes of vagal indigestion can be broad and varied. Numerous different pathologies can damage the vagal nerve, including traumatic reticulum peritonitis, reticular adhesions, leucosis, tuberculosis, hemangioma, hepatic lymphosarcoma abscesses resulting from the proximity between the liver and the reticulum (4), and displacement of the abomasum to the right (5). In addition, Gordon (6) has described the occurrence of vagal dysfunction due to a fibropapilloma.

Vagal indigestion is primarily attributed to cattle grazing under semi-intensive and intensive systems, and it is rare in small ruminants (7). The clinical manifestations of vagal indigestion in cattle include diminished appetite associated to gradual weight loss and a distended abdomen assuming a typical apple/pear shape. The rumen motility can be normal, decreased or increased; and the recurring tympanitis is common. Fecal excretion can be decreased or increased, and the feces can contain undigested material. Other common findings include bradycardia and a rectal temperature that is either normal or slightly above normal. The conventional treatments generally do not resolve the problem, and it is important to consider differential diagnoses such as traumatic reticle pericarditis, abomasal impaction, pyloric obstruction by a phytobezoar, and abomasal ulcers (8).

In Brazil, reports of vagal indigestion cases in cattle are scarce. This disease has only been described in two Brazilian dairy cows (one was four years old and the other one fifteen years old). Both of these cattle were raised in an intensive system (9, 10). Vagal indigestion has also been reported in miniature cattle, which have a predisposition to develop this disease (11, 12). The objective of this study was thus to describe the clinic-pathological findings from three cases of vagal indigestion observed in Zebu cattle in northern Brazil.

## MATERIALS AND METHODS

Three animals were examined in the period between 2008 - 2011 during visits to three different properties, two located in the northeastern region of Pará state, Brazil, [animals 01 and 02], and the third in Açailândia municipality in Maranhão state, Brazil, [animal 03]. This epidemiological study was conducted by the visits carried out to obtain information regarding breeding, grazing, water sources, and health management on the properties. The three animals were clinically examined according to Dirksen *et al.* (1), their blood was collected by jugular venipuncture to obtain a complete blood count (CBC), and an atropine test. This atropine test

was performed according the techniques described by Dirksen *et al.* (1).

Animals 02 and 03 were examined during 30 days before being euthanized due to their poor prognoses. Necropsy was performed in both animals according to the animal welfare guidelines established by the National Council for Animal Experiments Control (CONCEA) (16). However, the owner of animal 01 did not authorize euthanasia, even though it was made clear that the animal's prognosis was poor.

## RESULTS

The animals were farmed extensively in *Brachiaria brizantha* pastures: one four-year-old Nellore cow (case 01) and two one-year-old crossbred Nellore x Zebu cattle [one female (case 02) and one male (case 03)].

The clinical examinations revealed lack of appetite, mild dehydration, rough coat, and a normal nutritional status in the three animals. Upon inspections of the digestive system, an evidence of undulating movements in the left paralumbar fossa was observed. These movements coincided with the ruminal movements and the contractions of the left ventral abdominal wall corresponding to the ventral sac of the rumen, which moved towards the dorsal region. The three animals had bilateral distension of the abdomen, with the ventral and dorsal regions being distended on the left side, and only the ventral region being distended on the right side (i.e., in the shape of an apple/pear) (Fig.1 A, B and C). Palpation revealed no stratification of the rumen content. During the auscultation of the forestomachs, incomplete rumen contractions were observed with a normal frequency in animal 01 and with an increased frequency in animals 02 and 03. Animal 01 had diarrhea present on the surfaces of the ischialtuberosties, but animals 02 and 03 had scant feces with a firm consistency.

CBC did not reveal abnormalities in any of the three cases. The atropine test was positive in the three cases, and the cardiac frequency increased by at least 16% after the application of atropine sulfate.

The necropsies of animals 02 and 03 revealed that the rumen and reticulum were distended, the size of the omasum and abomasum was reduced, and they had very little content (Fig. 2). In addition, the adhesion of the reticulum to the diaphragm was observed (Fig. 3), and the rumen content was shown to be homogenous with a foamy appearance, a viscous consistency and an olive green color (Fig. 4).



**FIGURE 1.** Vagal indigestion. Bilateral distension of the abdomen with left ventral and dorsal distension and right dorsal distension (apple/pear). A: case 01, B: case 03, and C: case 02./ *Indigestión vagal. Distensión bilateral del abdomen con distensión dorsal y ventral izquierda y dorsal derecha (manzana/pera). A: caso 01, B: caso 03 y C: caso 02.*



**FIGURE 2.** Vagal indigestion. Distended rumen, reticulum, compacted omasum and abomasum with scarce contents (case 02). / *Indigestión vagal. Rumen distendido, retículo, omaso compactado y abomaso con escaso contenido (caso 02).*



**FIGURE 3.** Vagal indigestion. Adhesion of the reticulum to the diaphragm (case 02)./ *Indigestión vagal. Adherencia del retículo al diafragma (caso 02).*



**FIGURA 4.** Vagal indigestion. Homogeneous rumen content with a foamy viscous consistency and an olive green color (case 03)./ *Indigestión vaginal. Contenido ruminal homogéneo con consistencia espumosa viscosa y color verde olivo (caso 03).*

## DISCUSSION

Diagnoses of vagal indigestion have been reported in European animal species, their crossbred offspring, and in miniature cattle raised under semi-intensive or intensive systems (4, 5, 9,17). The cases reported in this study were unique because the animals belonged to Zebu cattle raised under an extensive system, meaning that this is the first Brazilian study to report the occurrence of vagal indigestion in Zebu cattle raised under this production system.

In the cases reported in the current study, the clinical symptoms observed were apathy, anorexia, weight loss, dehydration, dull and rough coats, diarrhea in case 01, and scant feces with a firm consistency in cases 02 and 03. These general clinical findings corroborated the data described in the literature regarding the clinical symptomatology of vagal indigestion (2, 4, 13, 15). Animals with vagal indigestion commonly develop bradycardia, which is defined as a heartbeat less than or equal to 60 beats per minute. However, not all animals with vagal indigestion present these symptoms, as it was observed in this study. Consequently, the possibility of vagal nerve damage cannot be discarded due to the absence of bradycardia (4).

The abdominal distension observed in the upper and lower left quadrants and in the lower right quadrant (the “apple and pear” shape) is a characteristic finding for vagal indigestion (8, 9). The abdominal distension

developed due to a progressive increase in rumen volume resulted when the flow of the ruminoreticulated contents into the omasum and abomasum is stopped, as it was observed in the three cases reported. In some cases of vagal damage, the animals have been reported to exhibit an increased frequency of rumen contractions. However, these contractions are ineffective and the intake accumulates in the rumen and the reticulum (3, 5, 8). These contractions can be observed as prominent undulations in the left paralumbar fossa (8), which is consistent with the observations of the cases studied here.

In this study, the results of the hematological exams of the animals were normal. CBC are useful tools to indicate inflammatory processes that can cause damage to the vagal nerve (8). However, CBC values can be normal if the inflammatory process has already been relieved or it is due to a chronic process. The necropsies of the animals researched here confirmed that the inflammatory process had already been mitigated, but several remaining sequelae were manifested as adhesions.

The diagnoses of vagal indigestion were based on the history, clinical symptoms and a positive atropine test. However, the cause of the nerve damage was generally difficult to establish because the origin of such damage cannot be determined only with a clinical exam in many cases. Therefore, the cause of this damage is only determined after necropsy in many cases (8). The prognosis for this disease was poor, and the symptoms were progressive, making it frequently necessary to euthanize the animal (15). Indeed, euthanasia was performed in cases 02 and 03, both of which presented progressive clinical symptoms with compromised the general health. Both of these animals had also positive results on the atropine test, which for some authors, constituted a proof of the vagal nerve damage (1).

The findings of necropsies from cases of vagal indigestion primarily showed changes in the size and content of the forestomach and stomach, with the nerve damage being a possible cause (3, 5). In cases of anterior stenosis, the rumen and reticulum were dilated with an abundant homogeneous rumen content that had a foamy viscous consistency and an olive green color. In addition, the omasum and abomasum were reduced in size, and their content was compacted and reduced, as it was observed in cases 02 and 03. These findings were similar to those of Dirksen *et al.* (1), Sattler *et al.* (5) and Curtis and Groot (13).

In the cases described here, necropsies helped to establish the cause of the vagal nerve damage. A

reticular adhesion to the diaphragm has been shown to cause damage to the ventral abdominal vagus nerve and has been classified according to Nadalian (15) as an anterior stenosis with hypermotility of the reticulorumen.

## CONCLUSIONS

Given the findings of this study, we conclude that vagal indigestion is a disease that can affect animals at any age, breed, and grazing system. The present study provides the first case report of vagal indigestion in extensively reared Zebu cattle in Brazil.

## CONFLICT OF INTEREST STATEMENT

None of the authors of this paper have a financial or personal relationship with other people or organizations that would inappropriately influence or bias the content of this paper.

## REFERENCES

1. Dirksen G, Gründer HD, Stöber M. Medicina interna y cirugía del bovino. 4ª ed. Buenos Aires: Inter-Médica. 2005.
2. Lacasta D, Climent M, Ferrer LM, Ramos JJ, Figueras L, Borobia M. Vagus indigestion resulting from a *Cysticercus tenuicollis* cyst in an adultewe. *Small Ruminant Res.* 2013;110(1):62-64.
3. Braun U, Rauch S, Hässig M. Ultrasonographic evaluation of reticular motility in 144 cattle with vagal indigestion. *Vet Rec.* 2009;164(1):11-13.
4. Braun U, Hausammann K, Oertle C. Hoflund syndrome due to anterior functional stenosis in 20 cows. *Berl Munch Tierarztl Wochenschr.* 1990;103(6):192-197.
5. Sattler N, Fecteau G, Hélie P, Lapointe JM, Chouinard L, Babkine M, *et al.* Etiology, forms, and prognosis of gastrointestinal dysfunction resembling vagal indigestion occurring after surgical correction of right abomasal displacement. *Can Vet J.* 2000;41(10):777-785.
6. Gordon PJ. Surgical removal of a fibropapilloma from the reticulum causing apparent vagal indigestion. *Vet Rec.* 1997;140(3):69-70.
7. Borges JRJ, Moscardine ARC. Indigestão vagal. In: Riet-Correa F, Schild AL, Lemos AA, Borges JRJ. Doenças de ruminantes e equídeos. 3ª ed. Vol 2. Santa Maria: Pallotti. 2007; 349-352.
8. Radostits OM, Clive CG, Blood DC, Hinchcliff KW. Clínica veterinária. Um tratado de doenças dos bovinos, ovinos, suínos, caprinos e equinos. 9ª ed. Rio de Janeiro: Guanabara Koogan. 2002.
9. Fernandes GO, Filappi AR, Cecim M, Leal MLR. Indigestão vagal causada por linfossarcoma em bovino. 2008. <http://www.sovergs.com.br/conbra-vet2008/anais/cd/resumos/R0715-1.pdf>.
10. Romão FTNMA, Barberini DJ, Gomes RG. Estenose funcional pilórica em vaca leiteira: relato de caso. *Rev Acad Cienc Agrar Ambient.* 2012;10(1):99-103.
11. Santos GGF, Stuchi RS, Deschk M, Rodrigues M, Cadioli FA, Rodrigues CA, *et al.* Indigestão vagal em uma minivaca: relato de caso. *Vet Zootec.* 2010;17(Sup11):40.
12. Amorim RM, Santarosa BP, Dantas GN, Ferreira DOL, Rodrigues CA, Hussni CA, *et al.* Indigestão vagal em seis mini-bovinos atendidos na Clínica de Grandes Animais FMVZ-UNESP/Botucatu. 2011. <http://www.sovergs.com.br/site/38conbravet/resumos/963.pdf>.
13. Curtis RA, Groot JJ. Vagus indigestion related to a liver hemangioma. *Can Vet J.* 1967;8(3):75-76.
14. Fubini SL, Ducharme NG, Murphy JP, Smith DF. Vagus indigestion syndrome resulting from a liver abscess in dairy cows. *J Am Vet Med Assoc.* 1985;186(12):1297-1300.
15. Nadalian MG. Vagus indigestion syndrome in cattle. *J Vet Fac Univ Tehran.* 1990;45(1):23-35.
16. National Council for Animal Experiments Control - CONCEA, V do art. 5o da Lei No. 11.794, of the 8 de October of the 2008.
17. Rehage J, Kaske M, Stockhofe-Zurwieden N, Yalcin E. Evaluation of the pathogenesis of vagus indigestion in cows with traumatic reticuloperitonitis. *J Am Vet Med Assoc.* 1995;207(12):1607-1611.

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