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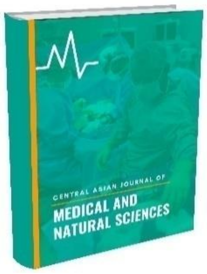

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Anatomy, Histological, Patho-physiological Comparative Study of Abomasums Disorders in Cows and Buffaloes(A review study)

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Abstract: The abomasums, is the fourth chamber in the ruminant. It functions similarly to the carnivore stomach as it is glandular and digests food chemically, rather than mechanically or by fermentation like the other 3 chambers of the ruminant stomach. The vasculature of the abomasum includes the cranial mesenteric artery, the celiac artery and the left gastric and left gastroepiploic arteries. The innervations(nerve supply) of the abomasum includes the dorsal vagus nerve(X c. n.) and the ventral vagus nerve (most important).There are 3 layers of tunica muscular - inner oblique, middle circular and outer longitudinal. The lamina muscular is thicker and has 3 separate layers. Gastric glands are present in the lamina properia of the mucosal layer in the pyloric region (lighter part).

The study included many aspects of the relationship of buffalo and cattle with the development and pathology of the fourth stomach from the internal and surgical aspects. The article touched on five important titles, each title related to the title that follows it. Rennet is the true stomach of ruminants and receives the digested food from other parts of the digestive system. Digestion is similar in ruminants, but the difference in living conditions is that cows live in fields or areas under the shade, while buffaloes live in swamps most of the time. By reviewing the references, we found a great similarity in pathology despite the different nature of living.

Key words: buffaloes, anatomy, histology, Abomasums displacement, abomasitis, cattle

Introduction

Natural life and nutrition of cows and buffaloes

The buffalo (*Bubalus bubalis*) is an important contributor to milk, meat, power, fuel and leather production in many developing countries. Buffaloes could be categorized into Asian and Mediterranean buffaloes. Asian buffalo have two subspecies known as the Riverine and Swamp types. The River (water buffalo) and Swamp buffalo possess different genetics (50 vs. 48 chromosomes, respectively), morphology (body frame, body weight, horn shape and skin color) and behavior (wallowing in mud or water) thus are reared for different purposes (Sarwar *et al*., 1994; Sarwar *et al*., 2002a;Sarwar *et al*., 2002b). Buffalo meat is the healthiest meat among red meats known for human consumption because it is low in calories and cholesterol. It has almost 2-3 folds cost advantage over mutton and goat meat.(APEDA, 2008).

Dairy cow longevity is the length of life of the animal, which in turn is determined by either culling decision made by the producer or death of the animal. The removal of cows from dairy herds due to old age is rare in the modern dairy industry and the economic interest associated with farm animals, which require them to achieve expected production levels, to reproduce regularly, and stay healthy (Essl,1998; Fetrow *et al*.2006). Whereas the classical topics such as gastrointestinal digestion, absorption and secretion, ruminant intermediary metabolism, regulation of feed and water intake, the rumen as mediator between diet and host metabolism, reproduction, lactation and growth, comparative and integrative physiology and the ontogenesis of the newborn ruminant were of major relevance as in previous symposia several new and highly actual topics have also been integrated into the programme. These topics included inflammation and immunology, lifespan and productivity, biosensors and big data management and global change and ruminants underlining the incorporation of new research areas in ruminant physiology. They also reflect an increased relevance and public perception of animal husbandry regarding global climate changes as well as sustainable food production (Dickinson *et al*. 2013).

Anatomical, Histological and Function for Abomasums The abomasums is the fourth chamber in the ruminant. It functions similarly to the carnivore stomach as it is glandular and digests food chemically, rather than mechanically or by fermentation like the other 3 chambers of the ruminant stomach. The chemical breakdown of food. It secretes hydrochloric acid(HCL) and pepsinogen. It has some intrinsic motility. Impaired motility can cause distension. The movements are slow, contractions occur first in the proximal part and are more forceful at the pyloric part. Anatomically, the abomasums differs in its position within the abdomen, depending on fullness of the other chambers of the stomach, intrinsic abomasal activity, contractions of the rumen and reticulum (to which it is attached) and by age and pregnancy status.

Displacement of the abomasums to the left or to the right is a common disorder affecting dairy cows due to high concentrate feed. The structure, the abomasums lies upon the abdominal floor. The cranial part is split into the pylorus and body. There is also a caudal part. It is covered by the lesser omentum. It has 15-20 folds inside. The torus is at the pyloric exit. The outflow is fairly constant. There is motility at the pylorus (peristalsis) and some control at the pyloric sphincter. The abomasums is large in newborn animals. The proximal ends of the abomasal folds form a plug preventing reflux into the omasum. It has thin walls and a serosa covering. The vasculature of the abomasums includes the cranial mesenteric artery, the celiac artery and the left gastric and left gastroepiploic arteries. The innervations of the abomasums includes the dorsal vagus nerve and the ventral vagus nerve (most important).

Histologically, The abomasums has a simple columnar epithelium. There are 3 layers of tunica muscular is - inner oblique, middle circular and outer longitudinal. The lamina muscular is is thicker and has 3 separate layers. Gastric glands are present in the lamina properia of the mucosal layer in the pyloric region (lighter part). The abomasums is heavily coated by mucous for protection. The sub mucosa contains loose connective tissue, many blood vessels and unilocular adipocytes. The coiled glands in the lamina properia open into deep gastric pits. The inner mucosa is pink. Rugae are present in the pyloric region and a torus (large swelling) is present at the pyloric passage to narrow the lumen. The dark mucosa of the funds and body contains peptic glands.

Abomasal impaction of cows and buffaloes

Abomasal impaction is a rarely reported clinical condition in adult ruminants that occurs due to accumulation of excess solid materials in the abomasums with subsequent enlargement of the organ (Ashcroft,1983; Wittek,2005)

Bezoars are recognized as a form of concretion, which develop within the gastrointestinal tract of animals and humans. Based on their composition, bezoars are further categorized into five subtypes that include phytobezoars, trichobezoars, lactobezoars, medicinal or pharmacobezoars, and concretions (Anderson and St-Jean, 2002; Kishan *et al.,* 2003; Ku, 1996).

The results of a field study and clinical observations have shown that abomasal phytobezoariasis is one of the most common causes of death (Azizi *et al*., 2010). But reports on phytobezoars in buffaloes are few. This report presents an unusual case of abomasal impaction due to phytobezoariasis in buffalo. (Azizi and Mirza Aghazadeh, 2008) The long-term consumption of sand or soil-laden feed and water or the consumption of sand or soil by animals with trace element and mineral deficiency both lead to the accumulation of sand in the abomasum (Gul,2012; Frasser,1986; Cebra et.al,2010).These animals present with signs of inappetence, body weight loss, decreased milk yield, reduced rumen contractions, tympany, discharge of sandy faeces or constipation, lethargy, recumbency, and death within several weeks (Braun *et al.*,2008;Radostits *et.al*.,2000).Fig (1).

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Fig (1) Showing recovered phytobezoar on post-mortem, Singh *et al*. 2016

Abomasal inflammation (abomasitis) of cows and buffaloes

Abomasum usually herniates in umbilical hernia but presence of umbilical-abomasal fistula is rare in calves (Fubini and Ducharme, 2004).

An abomasal ulcer is the result of patho-physiological conditions in which the balance between the protective and destructive processes of the abomasal mucosa is altered and as such cannot oppose the destructive action of the gastric juice. Histological changes, abomasal ulcers have been divided into four types: type 1 being a superficial erosion of the mucous membrane, type 2 a deeper lesion eroding the larger blood vessels leading to substantial hemorrhage, and types 3 and 4 perforating the abomasal wall leading to local or general peritonitis, Later, BRAUN et al. (1991) introduced a more detailed sub typing of type 1 ulcers, ranging from a discoloration of the epithelium (type 1a) to distinct craters (type 1b, c and d). respectively (WHITLOCK, 1980; SMITH *et al.*, 1983). Gastrointestinal motility disorders are one of the most common digestive tract ailments among buffaloes which lead to great economic losses. Abomasal hypo motility is a prerequisite for abomasal displacement in cattle. Abomasal disorders of dairy cattle are mostly predisposed by metabolic disturbance, lactation stress and nutritional inadequacies (Constable *et al.*, 2017)

Table 1. Classification criteria for types abomasal ulcers in water buffalo BRAUN *et al.* (1991)

Ulcer subtype	Macroscopic appearance	Microscopic appearance
Type 1a	Erosions with minimal mucosal defects. Reddish or brown in colour (Fig. 2a)	Superficial erosion of mucosal layer with no or negligible inflammatory response (Fig. 2b)
Type 1b	Well-defined dark red to black spots with punched out appearance. The centre of the lesion was always clearly depressed (Fig. 3a)	Mostly trough-like erosions of the mucosal layer with mononuclear cell or neutrophil infiltration. The necrosis of epithelium sometimes extended as far as the sub mucosa (Fig. 3b)
Type 1c	Craters with a superficial coating of dead organic matter, faecal matter. The margins usually formed a bulge (Fig. 4a).	Deeper sloughing of the mucosal layer with chronic inflammatory response in the surrounding area, extending up to the sub mucosa (Fig. 4b).
Type 1d	Ulcers with radial wrinkles and sometimes with ulcers on the mucosal folds (Fig. 5a).	Superficial or deep erosions of the mucosal layer with chronic inflammatory response in the surrounding area (Fig. 5b)

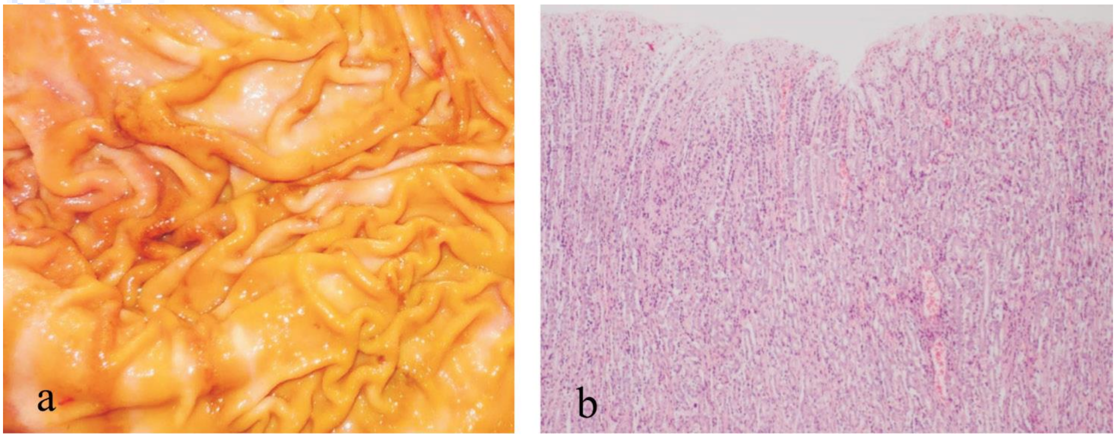


Fig. 2. Gross (a) and microscopic (b, ×100) appearance of a Type 1a abomasal ulcer. (Hussain et.al.,2019)

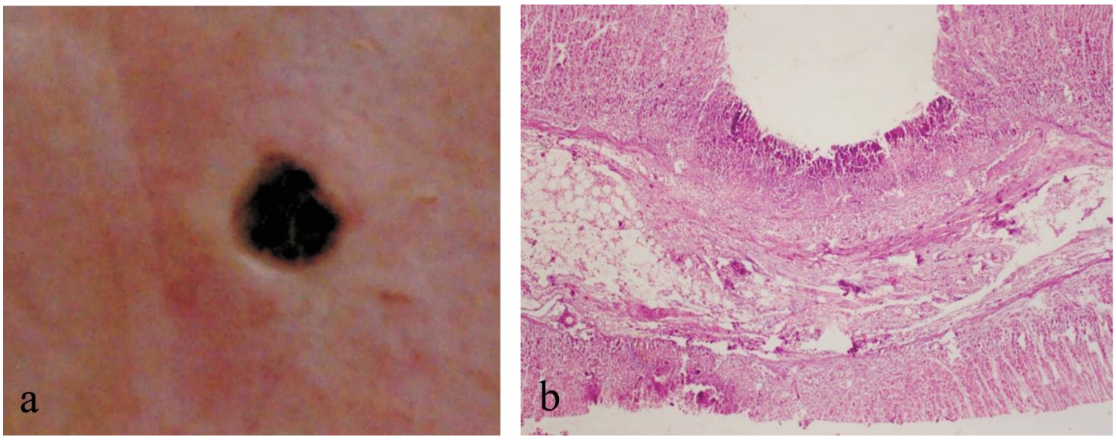


Fig. 3. Gross (a) appearance of a Type 1b abomasal ulcer; section of the abomasum (b) showing atrough-like Type 1b ulcer (×100). (Hussain et.al.,2019)

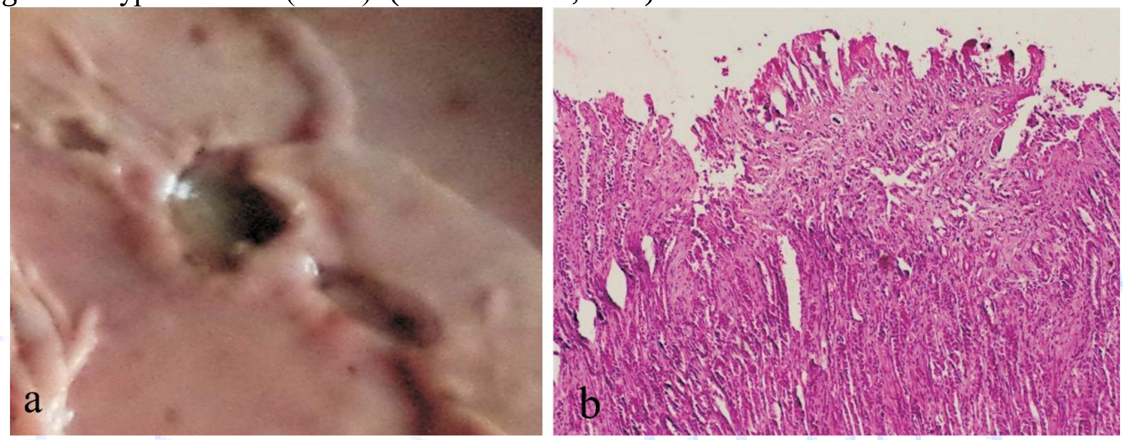
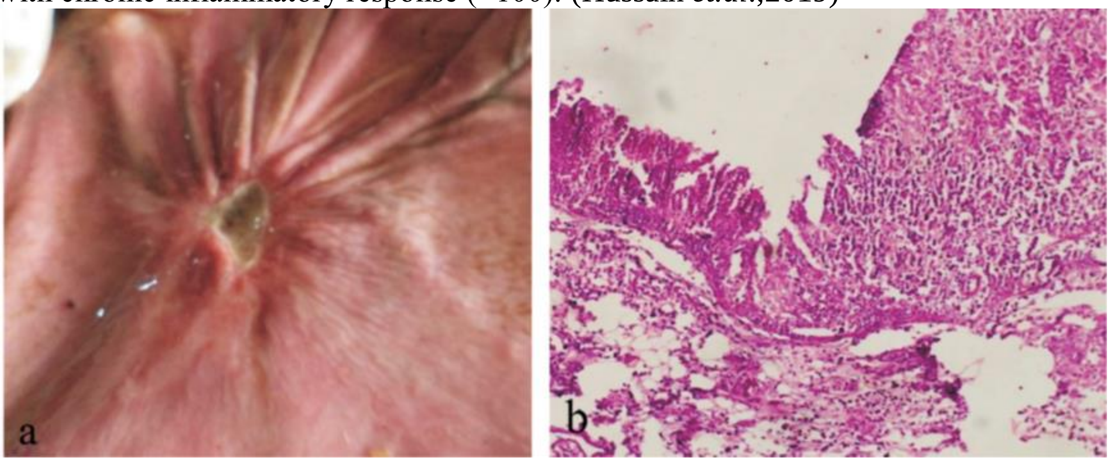


Fig. 4. Gross (a) appearance of a Type 1c abomasal ulcer; Section of the abomasum (b) showingan ulcer with chronic inflammatory response (×100). (Hussain *et.al.*,2019)



Gross (a) appearance of a Type 1d abomasal ulcer, section of the abomasum (b) showing an ulcer with inflammatory response and fibrosis (×100), (Hussain *et.al.*,2019)

Abomasal displacement of cows and buffaloes

Medical therapy is seldom used alone for treatment of abomasal displacements, but is combined frequently with surgical correction. Goals of medical therapy include correction of the underlying cause of the abomasal atony, promotion of GI motility,and correction of metabolic derangements. The restoration of abomasal motilityshould result in gas being expelled and allow it to return to its normal anatomic position.2 Oral or systemic calcium to correct hypomotility owing to hypocalcemia may beuseful. Promotility agents such as parasympathomimetic agents can help to stimulateGI motility. Dehydrated animals or animals that suffer from severe electrolyte imbalancesmay benefit from oral or systemic fluid therapy. Postoperative ileus and abomasal hypomotility can be a complicating factor in cattle undergoing surgical correction of LDA. Preoperative erythromycin can increase thepostoperative abomasal emptying rate in these cattle (Wittek *et.al.*,2008).

The left displacement of the abomasum (LDA) isa common disease in periparturient dairy cows (Zurr, Leonhard-Marek, 2012). Plasma β-hydroxybutyrate (BHB) levels above the reference range are regarded as risk factors for the occurrence of LDA (Zurr, Leonhard-Marek, 2012). Cows with displacement of the abomasum (LDA) are at increased risk of complicated ketosis and metritis (Radostits et al., 2007).

Abomasal surgery

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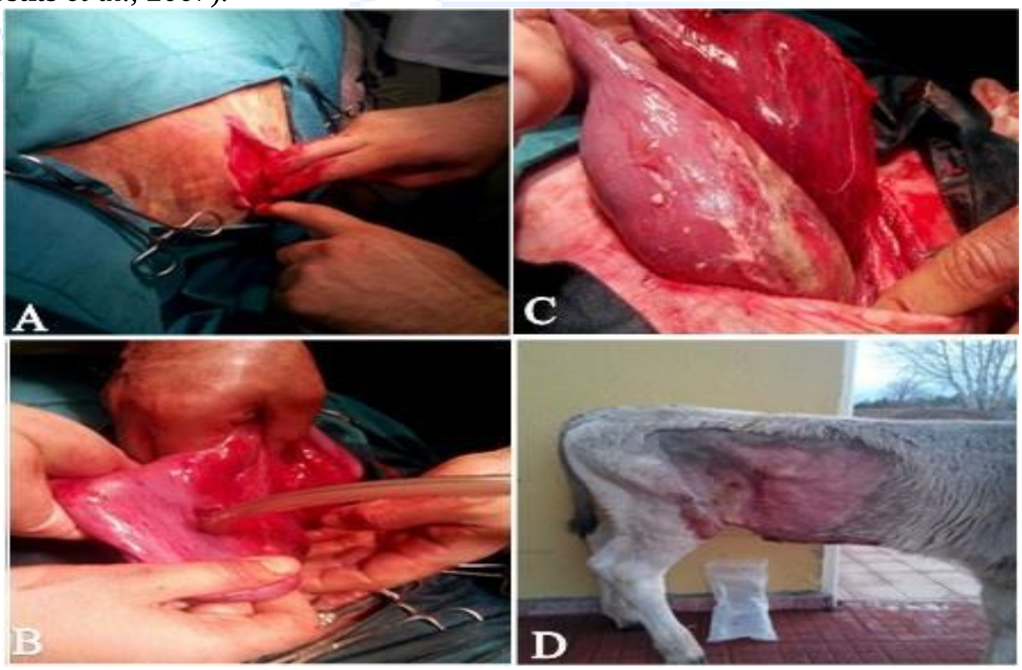

Fig 2. A. Abomasal tension, Fig 2. B. Emptying of abomasal content, Fig 2. C. Abomasitis and fibrin, Fig 2. D. Appearance of the calf after the operation.

Şekil 2. A. Abomasal gerginlik, Şekil 2. B. Abomasal içeriğin alınması, Şekil 2. C. Abomasitis ve fibrin, Şekil 2. D. Operasyon sonrası buzağının görünümü.

Conclusions

One can, in general, agree that epidemiological and experimental research both have contributed to the insight into the pathogenesis of DA. However, there is little co-operation between both fields of research. Epidemiological studies generate hypotheses, which are seldomevaluated by experimental work. When experimental work does evaluate epidemiological findings, these epidemiological findings sometimes cannot be explained and even contradictions do occur. It is reported that calcium blood concentrations are 0.1 to 0.2 mmol/L lower in cows priorto DA, compared to healthy counterparts. However, these levels are higher than calcium levels that decreases abomasal motility(1.2 mmol/L). Contradictions occur in the glucose levels prior to DA: epidemiological studies report lower concentration sprior to DA, whereas high levels of glucose are associated with hypo motility of the abomasum in healthy cows. Anotherincongruent finding is the feed intake: feed intake is lower prior to DA, while high levels of VFA concentrations and osmotic pressure of the rumen contents, both aresult of high levels of feed intake, are reported as reducing the abomasal motility. These incongruent findings are in most cases due to a low number of experimental animals or to extrapolation of sheep results to cows. Although costs should be takeninto consideration, further research is preferably performed on cows in sufficient numbers (at least 20). These experiments could generate advice for feeding practicein order to prevent high incidence of DA.During the experiments causative factors should be evaluated. Besides variable sconcerning the NEB, endo toxins and radicals could be evaluated. When discriminating variables are distracted an in vitro study can confirm the causative relation. With these in vitro studies emphasis should be made on the production of gas in the abomasums and the effects on the contractility of the abomasal wall. By monitoring milk, blood, rumen and abomasal fluid a predictor of DA could be distracted. This predictor might be used in dairy practice to identify animals that are at high risk for DA.The indicator should be easy to access and cheap. During current dairy cow husbandry emphasis should be on the transition periodof the postpartum dairy cow, since this is the period at risk for DA. By optimizing the ration in the dry period (prevent obesecows), facilitate the adaptation process of the lactating cow (socially and nutritionally by adding dry cow two weeks before the estimated calving date) and optimize postpartum feed intake (prevent concurrent diseases), the problem regarding displacement of the abomasum could be reduced to a minimum.

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