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Gross Anatomy of the Stomach of the *Oryx dammah* (Cretzschmar, 1826)

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Abstract: Problem statement: The Oryx antelope is a grazing ruminant of the Bovidae family. The macroscopic anatomy of the stomach in one adult *Oryx dammah*, an extinct species in the wild, was described. **Approach:** The stomach of the Oryx was composed of the four classic compartments of the ruminants. The weight of all the full stomach was 21.5 kg. The ruminal papillae were distributed unevenly in the rumen. **Results:** The maximum height of the cristae reticuli was 0.3 cm. The *Cellulae reticuli* were divided and contained secondary and tertiary crests. The *Curvatura omasi* measured 30.0 cm and the omasum had 15 primary, 9 secondary, 30 tertiary and 34 cuaternary *Laminae omasi*. The abomasum had about 17 *Plicae spirales abomasi*. **Conclusion/Recommendations:** We concluded that the stomach morphology of the Oryx had characteristics of the others grazing feeders ruminants. An important limitation of this study is the fact that we used only one animal, further studies of the digestive system of this species are necessary.

Key words: Grazing feeders ruminants, macroscopic anatomy, dissected immediately, stomach morphology, anatomical description, dissected immediately

INTRODUCTION

The classification of ruminants into three groups according to their feeding types (browsers, intermediate feeders, grazers) has been linked to anatomical studies, mainly of African, European and North American species (Hofmann, 1973; Dobson and Dobson, 1988).

Hofmann (1973) dissected ten animals of the two east African subspecies of *Oryx beisa*. Oryx antelopes are the only predominantly grass eating ruminants in East Africa which are adapted to extreme arid conditions without surface water (Hofmann, 1973). According to the same author *Madoqua kirkii* and *Litocranius* walleri which thrive under similar conditions, are browsers and Nanger granti is an intermediate feeder.

In this study we described the stomach of one Scimitar-horned Oryx (*Oryx dammah*) of Tunicia, North Africa. According to our knowledge there is no available information on the macroscopic anatomy of the stomach of *Oryx dammah*.

This animal is extinct in the wild according to the IUCN red list IUCN, 2008. Overhunting and habitat loss, including competition with domestic livestock, have been reported as the main reasons for the extinction of the wild population of Scimitar-horned Oryx (East *et al*., 2001; Beudels-Jamar and Devillers, 1998).

MATERIAL AND METHODS

One adult male *Oryx dammah* of the Frigya Zoological Park, Enfidha, Tunisie, was used in this study. The age of the animal was 8 year. The body condition was excellent and the body weight was 110.0 Kg. The animal was dissected immediately after being found dead. The ventral abdominal wall was removed. The stomach was removed after sectioning the oesophagus just prior to the diaphragm and the pylorus just before the duodenum. Stomach content was measured by weighing the unopened organ and re-weighing it after it had been opened and contents rinsed with tap water and dried with paper towels. Anatomical measurements were taken following standard procedures used by Hofmann (1973) or Clauss indications (personal communication); in brief, the ruminoreticulum was placed on its left side and the height and length of the rumen and the reticulum, the length of the *Curvatura omasi* were measured with soft measuring tape. After incision and emptying of the

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stomach compartments, the dimensions of the Ostia intraruminale, ruminoreticulare and reticuloomasale were measured by tape; the thickness of the cranial and caudal rumen pillars and the maximum height of the reticular crests and papillae unguiculiformes were measured with calipers. The *Lamina omasi* were removed and counted according to their order. The stomach full and empty weights were registered.

Pictures were taken with a Sony digital camera. Terms are used in agreement with the Nomina Anatomica Veterinaria 2005.

RESULTS

The stomach of the Oryx was composed of the four classic compartments of the ruminants (Fig. 1 and 2).

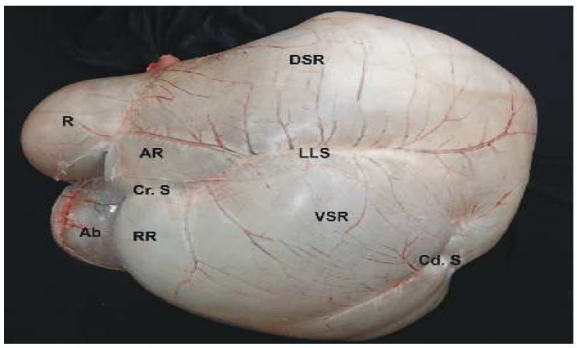

Fig. 1: Left view of the *Oryx dammah* stomach. E: Esophagus; DSR: Saccus dorsalis; AR: Atrium ruminis; RR: Ruminal recess; VSR: Saccus ventralis; LLS: Sulcus longitudinalis sinister; Cr.S: Cranial sulcus: Cd. S: Cudal sulcus; R: R*eticulum*; Ab: Abomasum

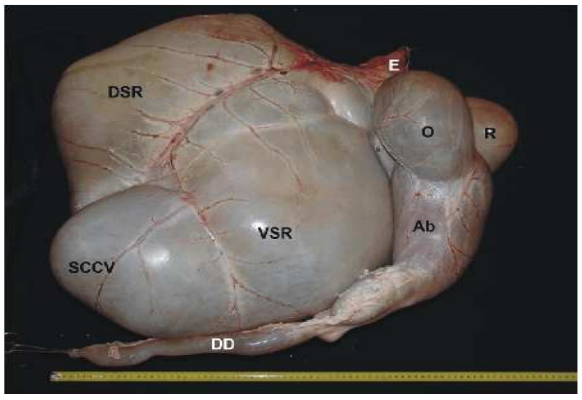

Fig. 2: Right view of the *Oryx dammah* stomach. E: Esophagus; DSR: Saccus dorsalis; VSR: Saccus ventralis; SSCV: Saccus cecus caudoventralis; R: Reticulum; O: Omasum; Ab: Abomasum, DD: Descending duodenum

The weight of all the full stomach was 21.5 kg. The empty reticulorumen weight was 3.0 kg.

Lengths of the dorsal and ventral sacs of the rumen were 50.0 cm and 54.0 cm, respectively. The height of the rumen was 52.0 cm. The Saccus caecus caudoventralis not extended more caudally than the Saccus caecus caudodorsalis (Fig. 1). The dorsal sac communicated with the ventral sac by the Ostium intraruminale, whose border was formed by the ruminal pillars and which measured diameters were 18×25 cm. The ruminal pillar thickness was 10.0 mm and 25.0 mm for the cranial and caudal pillars, respectively. The *Ostium ruminoreticulare* measured 11.0×11.0 cm.

The ruminal papillae were distributed unequally in the rumen and were more large and abundant within the atrium and in the two saccus cecus. The papillae were absent in dorsal part of the dorsal sac. The ruminal pillars had no papillae. The ruminal papillae gradually continued with the cristae reticuli cranially to the *Plica ruminoreticularis*.

The height of the reticulum was 19.0 cm and the craniocaudal length was 20.0 cm. The maximum height of the cristae reticuli was 0.3 cm. The *Cellulae reticuli* were divided and contained secondary and tertiary crests (Fig. 3). They were broader and deeper near the greater curvature and were becoming smaller toward the lesser curvature. The maximum length of *Papillae unguiculiformes* was 0.25 cm. The reticulo-omasal orifice measured 2.5 cm in diameter.

The weight of full omasum was 1.25 Kg and the empty weight was 0.8 Kg. The height of this organ was 17.0 cm and the craniocaudal lenght was 12.0 cm. The *Curvatura omasi* measured 30.0 cm. The omasum had 15 primary, 9 secondary, 30 tertiary and 34 cuaternary *Laminae omasi* (Fig. 4 and 5) and the sides of the laminae were marked by the presence of the *Papillae omasi*.

Fig. 3: Internal view of the Reticulum of the *Oryx dammah* stomach

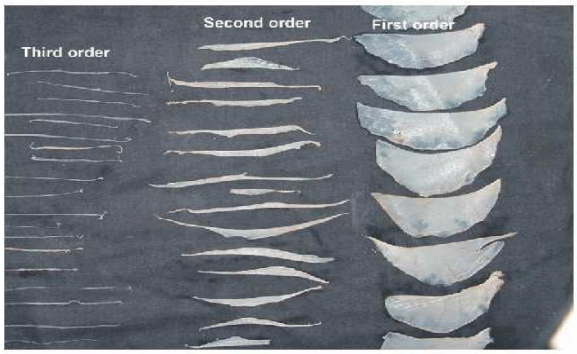

Fig. 4: Isolated three first orders of Lamina omasi of the *Oryx dammah* stomach

Fig. 5: Examples of the first order Lamina omasi of the *Oryx dammah* stomach

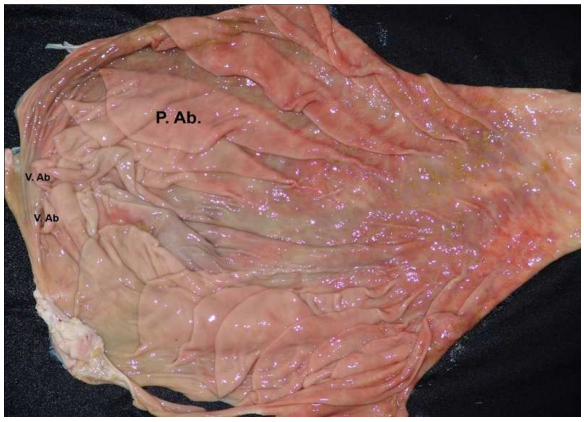

Fig. 6: Internal view of the Abomasum of the *Oryx dammah* stomach. V. Ab.: Velo abomasicum. P. Ab.: Plica spiralis abomasi

The abomasum full weight was 1.0 Kg and the empty weight was 0.6 Kg. The length of the curvature major was 55.0 cm and the length of the curvatura minor was 31.0 cm. The abomasum had about 17 *Plicae spirales abomasi* and the first one conformed the *Velo abomasicum* (Fig. 6) and a small *Torus pyloricus* was present.

DISCUSSION

This is the first anatomical description of the stomach of the *Oryx dammah*. An important limitation of this study is the fact that we used only one animal, but considering the extinct status in the wild of this animal, all research in this species is very important for the conservation of this marvelous animal.

Hofmann (1973) considered that the order by size of the different parts of the stomach in the antelope *Oryx beisa* was rumen, abomasum, reticulum and omasum. We found that the omasum had more content than the abomasum and its empty weight was also higher. To draw conclusions about the size of the different parts of the stomach we need dissect more animals and not only consider the external dimensions of the organs. The intraruminal papillation pattern was similar to those species that are characterized by a higher proportion of grass in their natural diet (Clauss *et al*., 2009). The finding of the great subdivided reticular crests is typical for grazing ruminants (Clauss *et al*., 2010). Grazing ruminants have in general higher reticular crests than browsers and more pronounced secondary, tertiary and even quaternary crests (Hofmann, 1973).

Hofmann (1973; 1989) and Dobson and Dobson (1988) and Langer (1988) and Clauss *et al*. (2006) confirmed that ruminants with a higher proportion of grass in their natural diet have larger omasa, similar to our studied animal. Hofmann (1973) found 35-36 *Lamina omasi* in *Oryx beisa*, we found more laminae.

CONCLUSION

This is the first anatomical description of the stomach of the *Oryx dammah*. We conclude that the anatomy of the stomach of *Oryx dammah* is characteristic of grazing feeder ruminants.

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