

Research article

Quantitative macroscopic digestive tract anatomy of the beira (*Dorcatragus megalotis*)

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Abstract

The digestive system of the beira (*Dorcatragus megalotis*), a small East African antelope, has not been described previously. We present anatomical data collected from the only known captive population of the species, allowing for a first understanding of the morphophysiological 'type' of this species. The gastrointestinal anatomy was quantified by weights, dimensions and areas, measured in a total of 19 beiras (ranging in body mass from 3.5 to 13.5 kg; not all measures taken in all animals). These characteristics were then evaluated against a comparative dataset consisting of data from both browsing and grazing ruminants. Overall, for example, in terms of reticular crest height, masseter mass and omasal laminar surface area, the beira digestive tract resembled that of the browsing 'moose-type' ruminants. A diet of dicotyledonous plant material was further supported by the carbon isotope composition ($\delta^{13}\text{C} = -27.5\text{‰}$) typical for C_3 plants of a faecal sample collected from a wild specimen, as well as the limited ecological information available for the species.

Introduction

The digestive anatomy of ruminants has been an object of continuous attention, due to the enormous diversity in morphological details across species (Garrod 1877; Neuville and Derscheid 1929; Langer 1973). While much of this work was motivated by the aim of inferring phylogenetic relationships (reviewed by Clauss 2014), it was the work of Hofmann (1968, 1973, 1988, 1989) that introduced the potential of digestive tract characteristics for studies of convergence, by linking the variation of a large number of morphological details with the three feeding types of browser, intermediate feeder and grazer. Convergence was more recently formally confirmed for several of these details (e.g. Hofmann et al. 2008; Clauss et al. 2010a). In order to enhance the clarity of the concept of comparing morphology on the one hand to the natural diet on the other hand, the terms 'moose-type' and 'cattle-type' were coined as descriptors of anatomy and physiology that can be juxtaposed to the botany-focused descriptors of the natural diet (browser vs intermediate feeders and grazers) (Clauss et al. 2010b). While a varying number of morphological details have been published for up to 90 ruminant species, the addition of any

new species to the catalogue is welcome in order to increase the power of future investigations of convergence. Here, we used the opportunity of access to digestive tracts of beira antelope (*Dorcatragus megalotis*) for the description of the macroscopic digestive anatomy of the species.

The beira is a small antelope from East Africa, with an area of distribution from the southern coast of the Gulf of Aden to the Horn of Africa in the east, to the borders of Somalia, Ethiopia and Djibouti in the west, and to the Marmar Mountains in north-eastern Ethiopia (Künzel and Künzel 1998; Nowak 1999; Heckel et al. 2008; Giotto et al. 2009). So far, only one population of beira antelopes has been maintained in captivity (Hammer 2011). The scarce information on the species derives from limited observations in the wild and extensive study of this captive group (Hammer and Hammer 2005; Giotto et al. 2008; Giotto et al. 2009; Hammer 2011). In their review of diets of African bovids, Gagnon and Chew (2000) estimated that beira consume 90% of dicot material, 5% fruit and only 5% grass in their natural diet, but considered the underlying information inadequate and hence the estimation unreliable. During sporadic observations, Giotto et al. (2008) recorded a list of 19 dicot and one monocot plant species that were