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The incisive arcade breadth, a relevant indicator of the bite mass for ruminants

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Take home message The incisive arcade breadth (IB), easily measurable using an inexpensive caliper is linked with body weight (BW) and explains variations in bite mass (BM).

Introduction BM is a key parameter in the forage acquisition, being the smallest scale in foraging and informing about larger scales. BM may vary at pasture according to sward characteristics as sward height, or herbage bulk density. However, BM depends also on animal traits, thus few relationships between IB and BW have already been proposed (Gordon, 1996). A quantitative review of the literature was carried out to obtain more generic relationships between IB, BW and BM, in order to provide useful and simple tools for monitoring nutrition and to better assess individual variations.

Materials & methods This work was performed from a meta-analysis of published data. The database comprised 6 publications, 27 experiments and 59 treatments (44 vs 15 with cattle vs sheep). The regressions were calculated intra-experiment for studies where IB varied significantly.

Results & Discussion

The IB (6.3 ± 1.9 , min=2.7, max=8.6 cm) is closely related to BW (327 ± 214 , min=26, max=618 kg):

$$IB(\text{cm}) = 0.91 \text{ BW}^{0.346} \quad (n=59, \text{ nexp}=27, \text{ RMSE}=0.27) \quad [1, \text{ Figure 1}]$$

The allometry coefficient of this equation is <1 and is fairly similar to that of Gordon *et al* (1996). Besides, there is a close intra-experiment regression between BM (0.56 ± 0.07 , min=0.1, Max=1.2 g DM/bite) and IB:

$$BM(\text{g}) = 0.023 \text{ IB}^{1.71} \quad (n=49, \text{ nexp}=22, \text{ RMSE}=0.10) \quad [2, \text{ Figure 2}]$$

The power coefficient is >1 , stressing the advantage of having a larger IB, propitious for forage acquisition for grazers. It could be seen as a systematic advantage of grazing cattle, compared with sheep (Figure 2). In the same dataset IB is also related to the theoretical diameter of the bite and therefore to the bite area, but not at all with the bite depth, which is more impacted by sward height in grazing conditions. BM is largely dependent of the volume of the bite, which depends of the opening of the mouth and of the extending of the tongue.

Figure 1 Influence of Body Weight on incisive arcade breadth.

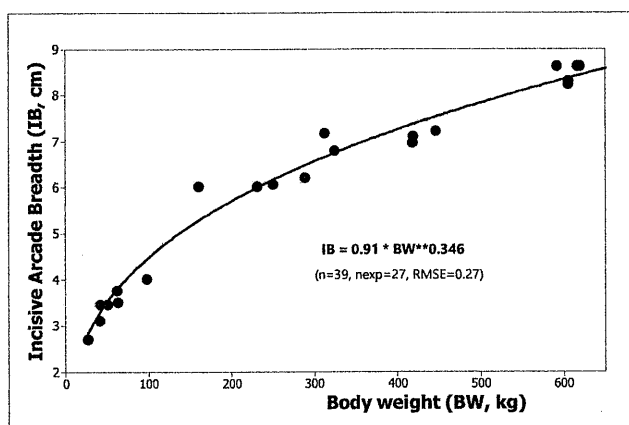
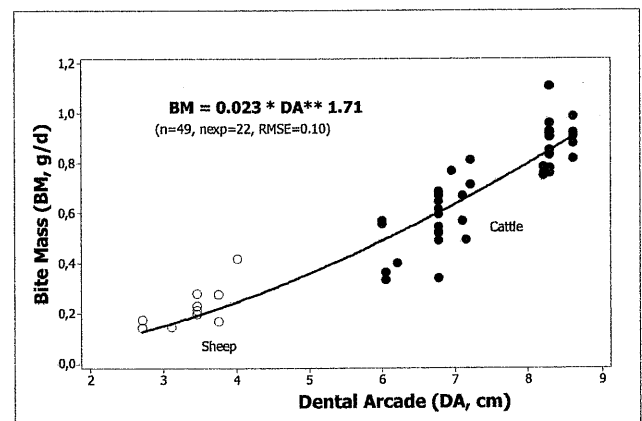


Figure 2 Influence of incisive arcade breadth on Bite Mass.



Conclusion The measurement of IB should facilitate the evaluation of BM since measuring IB is easy to implement and not expensive. BM depend also of sward characteristics (*i.e.*, sward height, herbage mass or bulk density) but the RMSE of the predictions by these sward characteristics are much higher than the prediction starting from IB. Moreover, IB is predictable from BW. Such a measure can help to better understand individual variations in the acquisition of forage, since we have noticed that the relationships between IB and BM vary significantly inter individual at pasture and likely indoor.

References

Gordon IJ, Illius AW and Milne JD 1996. *Functional Ecology* 10, 219-26.