Chew-bites, jaw movement allocation and bite rate in grazing cattle as identified by acoustic monitoring

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Introduction Bite rate derives from the time budget of the biting and chewing processes of intake, which are both performed by jaw movements. A new type of jaw movement was revealed by acoustic monitoring in cattle - the "chew-bite" -which chews herbage already in the mouth and harvests fresh herbage with the same jaw movement (Laca *et al.*, 1992). Chew-biting should enable the animal to reduce the total number of jaw movements performed per bite without reducing the number of chews per bite. We examined the variation among individuals in the allocation of jaw movements between the three types, and its relation to bite rate.

Materials and methods Nine Israeli-Holstein dairy heifers grazed pristine, continuous and homogeneous expanses of oats six weeks after sowing. Grazing sessions were recorded on video with acoustic monitoring, using a microphone on the forehead of the animal. Sward height was measured before grazing. A 5-minute session of uninterrupted grazing was extracted from these video recordings. The acoustic signal was sequenced aurally; each sound burst produced by a jaw movement was classified as a pure chew, pure bite or chew-bite. Chews per bite = the number of pure chews and chew-bites divided by the number of pure bites and chew-bites. Jaw movements per bite = total jaw movements divided by the number of pure bites and chew-bites.

Results Jaw movements maintained a virtually uninterrupted, regular rhythm of sounds (bite, chew or chew-bite). Mean rate of jaw movement was 78.9 min^{-1}, with a coefficient of variation (CV) of only 6%. There was high variability among animals in the allocation of jaw movements (CV for proportion chew-bites = 50%). On average, chew-biting accounted for 39% of jaw movements, the same proportion was allocated to pure chews, and the remaining 22% of jaw movements were pure bites. The proportions of pure chews and pure bites traded off directly against chew-biting. The mean biting rate was 48.2 min^{-1} (CV = 13%), and the animals invested 1.66 (CV = 13%) jaw movements per biting action and performed 1.27 (CV = 11%) chewing actions per biting action. As the proportion of chew-biting increased, bite rate increased and jaw movements per bite declined. Chews per bite showed no clear response to any of the variables (Figure 1). Linear regression of the number of chewing actions (pure chews or chew-bites) on the number of biting actions (pure bites or chew-bites) and pre-grazing sward height explained 87% of the variation.

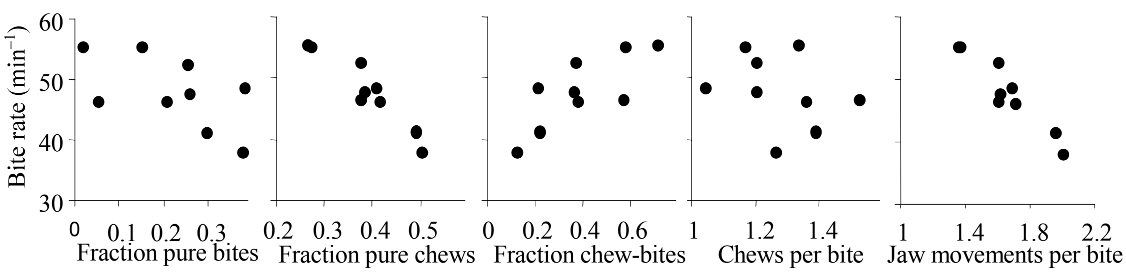

Figure 1 Relationships between bite rate and the proportion of jaw movements allocated to pure bites, pure chews and chew-bites, chews per bite and jaw movements per bite. Each point is a different animal

Conclusions Differences in bite rate among individuals derive primarily from differences in jaw movement allocation between the three types rather than differences in the rate of jaw movements. This allocation would appear to be constrained by chewing requirements. Animals that invest fewer jaw movements per bite by employing a high proportion of chew-bites may be more efficient grazers by virtue of a higher bite rate. Chew-bites can conceivably enable the animal to regulate bite weight to bring loading and processing rates into balance, thereby weakening the rationale to maximize bite weight. In most foraging environments this would allow the animal to improve diet quality.

References

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