Voluntary food intake by equids

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Controls of intake

The effect of gut fill on intake is equivocal because intragastric infusions of kaolin had no effect on intake whereas alpha-cellulose decreased intake in the same way as an infusion of glucose (*Ralston* and *Baile* 1982a,b). Possibly there is confusion between the effects of bulk, end products of digestion and the post-absorptive state. There is limited evidence to show reduced intake during the post-absorptive state following a glucose infusion (*Ralston* and *Baile* 1983). The absence of a structure analogous to the reticulo-omasal orifice as found in ruminants that regulates digesta flow on the basis of particle size, makes it unlikely that physical bulk will regulate intake. It seems unlikely that equids generally eat for "calories" in that, given the opportunity, resting animals will overeat and become obese. There is no information on the effect of circulating levels of VFA on intake but it is known that intragastric and intra-caecal infusions (*Ralston* et al. 1983) can have an effect although the physiological relevance of this is questionable. Extended photoperiod during the summer results in a higher voluntary dry matter intake (VDMI) that might indicate a hormonal effect. Unfortunately, there is a dearth of facts in relation to the controls of intake by the horse in contrast to the mass of information that has been accumulated for ruminants and simple stomached animals.

Estimates of feed intake

VDMI of hay varies from as little as 81 to as high as 122gDM/kgM$^{0.75}$; highest intakes were obtained with legume hays and this may reflect the different architecture of the fibrous components. Attempts to demonstrate a relationship between the content of neutral detergent fibre (NDF) and intake, analogous to that developed for ruminants, have been of limited success. *Cymabaluk* (1990) obtained an r^2 of 0.26, *Dulphy* et al. (1997b) achieved r^2 values of between 0.11 and 0.13 in contrast to that of *Lawrence* et al. (2001) value of 0.67. More recently *Reinowski* and *Coleman* (2003) published an r^2 value of 0.68. Perhaps these higher r^2 values are a reflection of the limited grass species examined. *Dulphy* et al. (1997b) proposed likely hay intake ranges for resting horses to be between 19-22 and between 22-25gDM/kgM for grass and lucerne respectively.

There are few data on pasture intake but what there are indicates a large range of between 85 (*Grace* et al. 2001) and 175gDM/kgM$^{0.75}$ (D. Smith and others, personal communication). *McMeniman* (2000) measured pasture intakes up to 30gDM/kgM although more recent work suggests values as high as 37.

Generally, horses consume much less straw than they would grass or legume. Measured intakes have ranged from ~45 (*Dulphy* et al. 1997a) to ~60gDM/kgM$^{0.75}$ (*Pearson* and *Merritt* 1991) for barley straws. Animals do not appear to be able to compensate low feed energy density by eating more although the gut will be less full than when fed grass hay. It would appear that the rate of comminution of straw is less than that of hay and thus there may be a feedback mechanism that relates time spent chewing to intake.

The VDMI of conventionally made clamp silage is a lot less than that of high dry matter haylages (39 vs.79gDM/kgM$^{0.75}$, *Moore-Colyer* and *Longland* 2000). This may be accounted for by the impact of the material on oro-pharyngeal receptors although we have no knowledge of the effect of fermentation characteristics on intake by horses in the same way as we have for ruminants. It would seem unlikely that dry matter content would affect intake in view of the fact that physical regulation seems unimportant in the horse. The nature of the forage ensiled appears to affect intake; ponies consumed significantly ($p<0.05$) more red clover silage than either grass silage or hay (*Hale* and *Moore-Colyer* 2001).

It is unusual to allow ad lib access to concentrate diets and thus few data are available although it seems that extended periods of time (~9 weeks) are required before intakes will stabilise (*Argo* et al. 2001). The VDMI of forage/concentrate mixtures by Thoroughbreds and Standardbreds in training varied between 22 and 32g/kgM according to a recent survey (*Respondek* et al. 2003).

There does not appear to be a consistently strong relationship between the NDF content of a feed and its consumption by horses. Intakes measured during short-term feeding trials (typically a 4x4 Latin Square would have treatment periods of 21 days or less) may be misleading and it seems that oropharyngeal monitoring may be of greater importance in the horse in relation to intake regulation.

Effects of processing feed

The extent of physical processing of forage will determine whether or not intake is affected; increasing feed density will lead to increases in intake but extreme treatments (eg. grinding and pelleting of forage) may depress NDF digestibility. Chopping can reduce the rate of consumption compared to when forage is fed in the long form. Reducing the density of a pelleted feed (extrusion vs. pelleting), or increasing the size of a meal or reducing pellet size have all been shown to reduce the rate (g/minute) of feed consumption. The addition of chopped forage to a concentrate meal does not reduce the consumption rate but pre-feeding forage reduces the rate at which concentrate is consumed. Presumably this is a satiety effect as meal-fed animals have a higher rate of consumption at the beginning of a meal than at the end.

Animal effects

Lactating mares consume more than either pregnant or nonbreeding animals of a similar breed type (161>116>104g DM/kgM$^{0.75}$ respectively, *Miraglia* et al., 2003). Mean retention time (MRT) in pregnant mares was similar to that of lactating mares and this suggests that foetal size was restricting gut capacity. There does not appear to be any age effects on intake when comparing ad lib fed weanlings with racehorses although ponies have a lower rate of consumption, a reflection of their smaller mouths/jaws.

General conclusion

The animal's daily rate of nutrient extraction from its food is a product of the total food ingested and the digestibility of that food. The strategy adopted by hind-gut fermenters is to eat relatively more than ruminants, especially of high fibre foods (*Janis* 1976). However, some experiments that have measured straw intakes suggest that this model is incorrect. Ponies fed ad libitum artificially dehydrated lucerne or oat straw consumed respectively, 155 or 94.7gDM/kgM$^{0.75}$ and when restricted to 0.7 of ad libitum intake, the equivalent figures were 70.2 and 67.5gDM/kgM$^{0.75}$ (*Pearson* et al. 2001). Ponies consumed less straw than lucerne. Was the lower VDMI of oat straw relative to lucerne, a reflection of its higher NDF content (715 vs. 443g/kg DM), lower OM digestibility (0.44 vs. 0.58), longer MRT of chromium-fibre (ad libitum, 31.5 vs. 21.3; restricted, 36.0 vs. 30.5h), lower CP content (38.8 vs. 146g/kg DM) or just greater faecal bulk? A recent review (*Smith* and *Pearson* 2005) compared the VDMI of donkeys and ponies with that of ruminants fed the same diets. NDF content of the feeds offered ranged from 379 (alfalfa) to 886g/kgDM (barley straw) and the mean VDMI (g/kgM$^{0.75}$) across all feeds was 71.0 for donkeys (n=29), 81.6 for cattle (n=9) and 85.2 g/kgM$^{0.75}$ for ponies (n=11). These authors demonstrated a significant relationship between DMI and diet quality index (gCP/gNDF) in cattle (r2=0.62, $p<0.01$), a less strong and non-significant relationship for ponies ($r^2=0.28$) and a poor relationship in donkeys ($r^2=0.08$). Based on this, the authors concluded that donkeys, and to a lesser extent ponies, are able to maintain intakes of poor quality forages known to depress intake in ruminants concurring in part with the views of Janis stated above. However, we have yet to discover what precisely regulates these intakes.

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