

## Dairy Ruminant Intake Orchestration via Frequency and Sequence of Feeding: Lights in Prospect

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### Editorial

This editorial seeks to critically discuss feed intake regulation cascade probably driven by feeding frequency (FF) and feeding sequence (FS) in dairy ruminants. The article also introduces research prospects for producing lucid and definitive conclusions to help develop on-farm applicable management strategies. A great deal of attention has been paid to FF in dairy ruminants [1-6]. A multitude of factors including dietary forage to concentrate ratio, total mixed ration vs. component feeding, cereal grain type, processing method, cow productivity, ambient temperature, and dietary use of bST and their interactions mediate cow response to FF. Once can the individual and interactive effects outlined above be determined, dairy ruminant response to FF may be quantified [1-2].

No effects of feeding dietary concentrate either 2 or 12 times daily on dry matter intake (DMI) in early lactation cows was observed [7]. Delivery of either a cubed or uncubed ration 2 or 4 times daily did not affect DMI in midlactation cows [8]. No differences in DMI of cows fed twice and four times daily was found as well [9]. In another study, DMI was increased by four times compared to twice delivery of a corn-based total mixed ration, likely due to greater total tract DM digestibility [10]. No significant effects of four times vs. once daily delivery of a corn grain-based TMR on DMI of midlactation cows was reported [11]. Monitoring circadian (i.e., almost 24-h) patterns of feed intake may help explain the underlying mechanisms of DMI response to FF. More recently, increasing FF from once to twice or from twice to four times daily increased average eating time per cow in group-fed lactating cows [12]. The more frequently fed cows had a more even distribution of eating over the 24-h period. Also, feed sorting was reduced by the more frequent feeding. This may improve fiber digestibility [13]. Nonetheless, the eating activity reported was based on the number of cows present at the feed bunk and not the amount of feed consumed within a certain time interval by individual cows [12]. Therefore, it was unknown if FF affected DMI.

Decreased circadian variations of eating may reduce circadian fluctuations of rumen pH [3,5], which may in turn reduce the risk of subacute rumen acidosis, and thus, improve fiber digestibility and rumen health [13,14]. However, before such a theoretical cascade turns into an on-farm reality, the more frequent feeding must prevent or minimize the time during which the rumen pH drops to the point that is detrimental to microbial metabolism. Unfortunately, this limit has not adequately been carefully and elaborately addressed in the literature, thus requiring future scrutiny and analysis.

The feeding sequence of forage and concentrate is another major variable that affects DMI in dairy ruminants [14,15]. A tendency for increased DMI was observed when a mixture of grain and protein meal was delivered at 0700 h followed by forage delivery at 1000 h,

compared to when forage was delivered first [14]. Usually, offering forage before concentrate early in the morning is thought to help form a thoroughly developed rumen fiber mat, which can in turn stimulate salivation [15]. This may reduce the risk of subacute rumen acidosis [6]. As a result of the controlled rumen pH, DMI may not drop [16,17]. However, such effects have not been accurately monitored in specifically-designed studies. To reiterate, before feeding sequence effects on DMI and feed intake regulation mechanisms can be quantified, the detrimental low rumen pH must evidently occur and be continuously monitored.

To conclude, lucid conclusions on real regulatory effects of FF and FS on DMI in dairy ruminants may not globally be drawn at this time. Simultaneous monitoring of circadian rhythms of DMI, rumen conditions, splanchnic and peripheral metabolic indicators, physiological health indices, feeding, ruminating and social behaviors, and salivation, among other variables, is a must before definitive and clear-cut answers on the above questions can be generated.

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