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Calf Note #225 – Factors affecting dry feed intake in calves

Introduction

Understanding how and why calves consume dry feed is critical to organizing feeding programs that provide for optimal growth without wasting nutrients

In [Calf Note #224](#), I reported on two equations that may be used to predict dry feed intake in calves to approximately four months of age. There were several variables that were important to those predictions and I'd like to discuss these variables and how they affect prediction of intake.

The Research

The simplest prediction equation for dry feed intake (DFI; calf starter + forage) in calves from 3 to 114 days of age was reported in the [2021 Journal of Dairy Science manuscript](#) as:

$$\text{DFI (kg/d)} = 1.4362 \times e^{[(-4.6646 + 0.5234 \times \text{MEgap}) \times \text{EXP}(-0.0361 \times \text{Age})]} + 0.0025 \times \text{Age} \times \text{MEgap}$$

There were only two independent variables needed to predict DFI in this equation. Note that the equation accounted for >90% of the variation in the dataset of more than 60,000 observations of daily dry feed intake.

The two independent variables included Age and “MEgap”. Let's look at each.

Effect of MEgap on dry feed intake. MEgap is a variable that calculates the difference (or “gap”) between intake of Metabolizable Energy (ME) from liquid feeds (milk or milk replacer) and the ME requirements of the calf for maintenance and growth. The MEgap variable is based on the idea that calves fed high grain diets, with or without milk, will eat dry feed until they've met their needs to maintain body weight and for growth. This idea that animals eat to meet an “energy endpoint” – i.e., to meet their energy needs – is quite well established in the scientific literature. Note, this relates to long-term intake (days, weeks and months) and not intake of meals within a day, which is more affected by other factors beyond the scope of this Calf Note.

The amount of ME required for maintenance is set by the calf's body weight, the climate (warm or cold conditions increase ME needs), and disease (increase ME). The 2001 Dairy NRC calculated maintenance ME based on BW, then adjusted this value for cold conditions. No heat adjustment was made in the 2001 publication, nor did they attempt to adjust ME requirements for disease states.

Next, we add the ME requirement for growth. This, of course, depends on the “target growth” of the animal. “Target” growth rates are based on the animal, breed, and genetics, but generally are in the range of about 1 kg/day for Holstein calves. Early in life, when the calf is less able to digest

feed, growth rates will be less than 1 kg. However, we can reasonably predict this need using growth modeling approaches, such as using Gompertz curves.

Once we have the ME needs for maintenance and growth, we calculate the ME intake from milk or milk replacer. This value is then subtracted from the ME requirements:

$$\text{ME}_{\text{maintenance}} + \text{ME}_{\text{gain}} - \text{ME}_{\text{milk}} = \text{ME needed from dry feed}$$

This is our “MEgap” variable.

Effect of Age on dry feed intake. Age is a factor not considered in the calculation of dry feed intake in previous studies with young calves. Of course, age and BW are closely related, but we’re considering the effect of BW in the MEgap variable. So, the effect of age, when included along with MEgap attempts to account for variation in dry feed intake that is due to age *per se*, and not simply because older calves are bigger.

Think of it this way – a 50 kg calf that is 7 days of age will likely eat less calf starter compared to a 50 kg calf that is 21 days of age. Why? The older calf most likely has seen calf starter (assuming the farmer has offered starter at an early age!) and recognizes it as food and a source of energy. The starter tastes good, and it makes the calf feel satisfied (i.e., it meets its energy needs). An older calf is also more capable of digesting starter due to maturation of the digestive system, so it is more able to eat starter and gain energy from it. Finally, an older calf is more accustomed to the routines on the farm and the act of feeding will prompt many calves to look for something to eat. We shouldn’t discount the effects of behavior on initiation of dry feed intake in young calves.

The final variable in the prediction equation was Age \times MEgap. This variable follows the idea that there is an interaction between age and energy demand. This relates to the age at weaning and size of the calf. It was highly important in all prediction equations, suggesting there are minimum ages at which calves are ready to be weaned.

Other factors also affected intake in our research, including ambient temperatures (increase MEgap), starter quality (lower ME in starter affects the calf’s ability to meet ME needs at a similar intake), and forage in the diet (lower ME in forage means the calf must eat more to meet its ME needs). Over the entire study, however, these were less important than age and MEgap. They were statistically significant, and some equations included these variables. When the data are available, including these variables will improve prediction of dry feed intake, though differences among these equations and the simplest equation were small.

Disease surely affects dry feed intake (anorexia, reduced digestibility, and increased ME maintenance requirements), but we had insufficient data to include this variable in our equations.

Summary

Understanding the biological mechanisms that influence dry feed intake is almost as important as the ability to accurately predict when and how much young calves will eat starter and forage. When we boil it down to its simplest, calves will eat dry feed after they’re old enough and when they need more energy to grow than they can consume from the milk or milk replacer they receive. Thus, calves fed more milk will eat less starter at a given age and begin eating starter at later ages than

calves fed less milk. All calves, regardless of age, need to learn to eat starter and we can't assume that simply because it's in front of them that they recognize it as food. Good quality, palatable calf starter, offered from an early age will help calves get off to a good start and prepare them for weaning. Feeding management is also important to promoting starter intake, and includes factors such as quality and palatable ingredients, physical form of starter, freshness, water availability, and consistency in feeding.

References

Quigley, J. D., T. S. Dennis, F. X. Suarez-Mena, C. E. Chapman, T. M. Hill, and K. M. Aragon. 2021. Models to predict dry feed intake in Holstein calves to 4 months of age. *J. Dairy Sci.* <https://doi.org/10.3168/jds.2020-19581>.

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