Characteristics of a Good Calf Starter and Feeding Program

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Periodically, I have been asked how to formulate a good calf starter feed? But the issue also is how is the starter fed and what is the impact? First, let's look at key product formulation issues.

Palatability Calves have a keen taste. They can pick out components in a starter if they do not like them. If in a pellet, they will reduce their intake of the pelleted portion; or if in a texturized starter pellet, they can reduce intake of the pellet alone. At a young age, calves can select portions they like or dislike just like goats can. Least cost formulating starters creates opportunities for significant ingredient changes and variable intake. Of all feeds fed to dairy cattle, more care and selection should be made for ingredients in a calf starter. Formulation changes should be small and spread over time. Calves like soybean meal over other protein meals. They can adjust to cottonseed or canola meal, but during changeover intake may decrease and be variable. Calves do not like fish meal, blood meal, and even distillers or corn gluten feed or meal. Corn and oats must be clean, and without mold or mycotoxins.

Pellet Quality This is critical no matter whether the pellet is in a texturized starter or in an all-pelleted starter. Calves do not like fines. They eat less, up to 11% in one study (Bateman et al., 2009). The best ingredient for pellet quality is wheat middlings. Unfortunately, it has a bad reputation as a "filler", but if the CP, NDF, and starch levels are known and properly assayed, it is an excellent ingredient. On the other hand, high CP starters have less room to use wheat middlings because too much protein meal is needed. So, lower the CP to no more than 18% as-fed which is about 20% on a dry matter basis, use more middlings, the calf will metabolically waste less protein, and feed cost will be lowered too. I find it incongruous that while we rightfully work to lower protein levels in cow rations to reduce protein/nitrogen losses into the environment, we are fixated on using higher CP levels in calf starters. The 2001 NRC Young Calf Model will not call for more than 18% CP on a DM basis if you have reasonable starter intakes. If intake is too low, then higher CP is not the solution—more intake is needed as energy is the limiting factor.

Corn Processing A Penn State study addressed this question using whole, dry rolled, roasted rolled, or steam flaked at 33% corn, 5% cane molasses, 16% whole oats, and 46% premix pellet comprised mostly of soybean meal (52%) and wheat midds (37%) for 19% CP as-fed (Lesmeister and Heinrichs, 2004; Kertz. 2005). Results were similar among treatments, but steam flaked had some poorer results as seen in some other studies too. This can possibly be because steam flaking can vary widely, highly flaked can be too fermentable, and highly flaked corn can crumble more easily resulting in fines. Cracking is generally okay if resulting in about 4-6 particles per kernel and fines are screened. But I have found in one case that really hard. flinty corn can be a problem as it can even be seen in feces. In a China study, we found a significant decrease in digestibility measured by both acid insoluble ash and indigestible NDF (Du et al., 2021.)

Oats or Barley Neither is necessary in a texturized starter. If used, there is no need or value in processing oats—let the calf do it. Barley is problematic for if unprocessed, it can largely go through the calf intact. I think this is because of its rounder shape and lighter density based on my field observations where it is quite evident in the feces. But because barley has highly fermentable starch, it should be processed minimally such as only rolling or cracking.

Proportion of Particles to Pellet in Texturized Starters This is not an exact science,

because particle size has not often been measured (Kertz. 2017, Ghaffari and Kertz 2021). I recommend a minimum of about 40-45% particles dependent on sizes of particles, and the pellet being about 45 to 55% of total formula. Molasses may be 3 to 5%, BUT molasses physical properties vary greatly; and it is not absolutely necessary. Molasses may be too sticky at times, especially with greater humidity; but too dry if humidity low is low. It can become moldy, but, can accumulate fines/dust and minimize that issue. Winter can make the starter blocky when in a bag or bin. And in the summer, it can become a fly attractant as we saw in the China experiment.

Starch/Fiber Levels Pelleted starters can have 35 to 40% starch, which without some roughage will lead to marginal ruminal acidosis. If starch is reduced and fiber increased in a pelleted starter, then ruminal acidosis may not occur--but rumen papillae will likely not develop as well either. Texturized starters can have 35 to 40% starch without issues because particle size leads to chewing and salivation which buffers the rumen and helps maintain more normal ruminal pH for young calves. Remember, ruminal papillae are stimulated to develop by VFAs in the order of butyric, propionic, and acetic last.

Fat Sources and Addition Generally, added fat in a starter is negative for intake and gain (Kertz 2013). Calves have low (~5.5) rumen pH—I think due to lack of a resident protozoal population at this young age. Unsaturated fatty acids kill rumen protozoa, such as in sheep and cow studies. Unsaturated fat is more negative for calf starters (Hill et al., 2015: Kertz 2016). Also, avoid distillers, soybeans, cottonseed, and other significant fat source ingredients as higher inclusion levels of these ingredients reduce intake..

Pelleted versus Texturized I still hear or read where others try to avoid or side-step this question as "controversial". My response is show me the data. And what is the biology here? Another dimension is that some people focus in research and in the field primarily on the milk/milk replacer feeding portion while others more on the starter. The calf needs to have both of these components integrated. The main principle here is the nature/VFA pattern of rumen fermentation in a young calf determines how well the rumen develops (Kertz 2014). And a well-texturized starter facilitates rumination earlier and more often than the same formula all pelleted (Porter et al., 2007). Pelleted starters result in lower calf rumen pH and marginal acidosis. That requires some roughage addition to compensate which will likely result in gut fill which confounds measuring real body growth. From a practical approach, how many dairy or calf operations can effectively and consistently buy, store, process, and add some roughage to feed with a pelleted starter? A Canadian study (Khan et al., 2011) fed what was called a "texturized" starter with starter alone or along with chopped orchard grass hay. The commercial starter had "14% flatted barley, 13% flatted oats, and 10% steamed corn". That totals only 37% texture, and all grains were processed. The table below reveals some key data from that study. First, the low rumen pH with the "texturized" starter fed alone shows there was not adequate texture. Astonishingly, calves which also had access to hay had 10.4 lb more rumen fill! Since calves on both treatments weighed the same, that means the calves with hay access gained 10.4 lb *less* true body growth. This study illustrates the need for enough and proper texture in a starter and the negative impact of forage creating gut fill in young calves

	Starter	**Starter plus Hay**
Rumen-reticulum + digesta, lb	17.6	28.0
Rumen-reticulum - digesta, lb	3.5	4.2
Rumen pH	5.06	5.49

The Bottom Line

Calves, like babies, like consistency. That not only applies to the milk/milk replacer program, but also to the starter and its feeding program**.** Starter formulations should be fairly constant with minimal ingredient and nutrient content changes**.** Texturized starters are "safer" for ruminal function, especially if inadvertently over-fed. Texturized starters provide a better platform for introduction of forage into calf feeding programs (Overvest et al. 2016: Kertz 2016)

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