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Calf Note 197 – Beet pulp in calf starters

Introduction

Determining the "quality" of calf starters is often an ill-defined concept. Feed tags define level of crude protein, fat, crude fiber, and some indication of vitamin and mineral content. However, the nutritive value of the starter to support adequate calf growth is not fully explained in these values. Most of a starter is actually carbohydrate. Consider a starter that contains 10% moisture, 5% fat, 20% crude protein and 10% ash (including vitamins, minerals and additives). The remainder (100 – 10 – 5 – 20 – 10 = 55%) is some type of carbohydrate, which can be sugars, starch, fiber, pectin and other types of carbohydrate. The form of these carbohydrates can dramatically influence the nutrition available from the starter. Unfortunately, it can be difficult to tell how well a starter will support calf growth.

A recent article published in the Journal of Dairy Science (Dennis et al., 2018) evaluated the inclusion of sugar beet pulp in calf starters and its effect on growth, intake and digestion in calves from 2 to 4 mo of age.

Beet pulp is a by-product of sugar beet processing. An interesting review of beet pulp and its nutritive value from North Dakota State university is here. Generally, we consider that beet pulp is an excellent source of digestible fiber for ruminants (Voelker et al., 2003a, b, c).

Item	0%	15%	30%	Hay
Ingredient, %				
Beet pulp	0.0	15.0	30.0	
Rolled corn	30.3	15.9	1.5	
Soybean meal	18.1	17.7	17.3	
Wheat midds	7.5	7.5	7.5	
Whole oats	20.0	20.0	20.0	
Whole corn	17.0	17.0	17.0	
Molasses	3.0	3.0	3.0	
Additives	4.1	3.9	3.7	
Nutrients, %				
DM	87.1	86.9	87.3	86.1
DM basis				
CP	18.2	18.3	18.4	9.6
ADF	7.8	11.1	14.8	44.2
NDF	16.4	20.5	23.3	67.4
Fat	4.1	3.9	3.3	1.6
Ash	5.8	4.4	7.7	9.0
Starch	43.5	34.9	25.7	1.7
Sugar	5.3	7.0	9.6	11.6
Pectin	2.9	5.6	7.2	2.1

Table 1. Ingredient and nutrient content of experimental diets.

The Research

Holstein calves (n = 48) that were approximately 2 months of age (58-60 days) were assigned randomly to receive calf starter diets (Table 1) that contained 0, 15, or 30% beet pulp. Beet pulp replaced rolled corn and soybean meal. The starter was a texturized starter that contained a pellet, along with whole corn and whole oats. Note the reduction in starch (44% down to 26%) and increase in NDF (16% to 23%) and pectin (3% to 7%) with increasing beet pulp in the starters.

Calves were fed a combination of 95% starter + 5% chopped hay, mixed into a TMR. Growth (change in body weight, hip width and body condition score) was monitored on day 28 and 56. Intake was measured daily and calves had free access to water at all times.

Growth, intake and efficiency of calves are in Table 2. Generally, calves consumed similar amounts of starter and had similar feed efficiency. And though final body weight (**BW**) did not differ among treatments, average daily gain and change in hip width were linearly affected by increasing beet pulp in the starter. And, though the differences were not dramatic, they were measurable under the controlled conditions of this study.

Perhaps the most consequential change in growth was change in hip width. Final hip widths of calves were 27.1, 26.1 and 26.1 cm for 0, 15, and 30% beet pulp, respectively. The change from beginning to end of the study was about 20% increase in hip width.

Item	0%	15%	30%	*P*
BW, kg				
Initial	78.5	76.7	76.7	0.59
Final	139.6	135.7	135.0	0.20
ADG, kg/d	1.09	1.05	1.04	0.01
DMI, kg/d	3.14	2.97	3.10	0.68
Gain : feed	0.35	0.35	0.34	0.38
Hip width change, cm	5.4	5.1	4.8	0.01

Table 2. Performance of calves fed different levels of beet pulp.

P = linear effect of increasing beet pulp in starter.

Reduced structural gain may be difficult to compensate for later in life; therefore, it is worthwhile to evaluate both growth in terms of BW gain and some indication of structural growth such as wither height, hip height or hip width.

Table 3 shows the differences in nutrient digestibility with increasing beet pulp in the diet. Clearly, as beet pulp in the diet increased, digestion of dry matter, organic matter, protein and starch increased. On the other hand, digestion of fiber (NDF, ADF) increased with increasing beet pulp in the diet.

From the digestibility data, it seems possible to construct a theory as to why average daily gain and structural growth differed with increasing beet pulp. The change in protein digestion was quite significant – increasing beet pulp from 0 to 30% reduced the digestion of protein by nearly 8%, perhaps making less metabolizable protein available. Further, changing the amount of starch available (and some ruminal starch) could also change the supply of microbial protein available for growth.

Reduced starch, DM and organic matter digestion means fewer nutrients and energy available for growth. So, the combined effect of reduced protein and energy available (due to lower digestibility) probably resulted in lower daily gain and structural growth.

Digestibility, %	0%	15%	30%	*P*
Dry matter	78.2	75.5	73.9	0.01
Organic matter	79.7	78.0	75.6	0.01
Crude protein	75.7	72.9	70.1	0.02
NDF	47.1	51.3	52.7	0.04
ADF	44.1	48.6	53.0	0.01
Starch	97.1	95.3	93.1	0.01
Fat	76.9	76.4	72.7	0.20

Table 3. Digestibility of nutrients in calves fed increasing levels of beet pulp in starter. Digestibility was measured on d 77-84.

P = linear effect of increasing beet pulp in starter.

Implications

Other research (Maktabi et al., 2016) also fed increasing amounts (0, 10, 20%) of beet pulp to calves from 0 to 70 d of age. Their results suggested that calves fed 10% beet pulp tended to consume more starter, had greater body weight gain and body weight prior to weaning on day 50. Growth and feed intake were not affected during the postweaning period (to day 70) or with increasing the level of BP in the diet. However, in this study, increases in ration NDF were from

14.2%, 17.1% and 19.9% of DM, so the highest level of NDF in this study was similar to the 15% level in the study by Dennis et al.

Increasing levels of beet pulp in the study by Maktabi et al. also increased amount of effective fiber, as well as ruminal parameters. These changes could be responsible for differences in performance observed in this study. However, because Dennis et al. also fed 5% chopped hay in their rations, sufficient effective fiber may have already been provided, so that increasing amounts of beet pulp did not improve calf performance.

Summary

Generally, when protein levels are >18% of DM and sources of protein are highly digestible and with good amino acid profile (e.g., soybean meal), the availability of metabolizable energy generally limits growth of young calves. Using greater amounts of fibrous ingredients such as beet pulp, with a concomitant reduction in energy concentration and nutrient digestibility, may negatively affect growth (total BW gain and structural growth), in calves to four months of age. Studies have shown that increasing the amount of fiber from sources such as beet pulp may affect performance, depending on the fiber level of the diet and the effect of beet pulp on the rumen environment.

References

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