Diluting heifer diets with straw studied

Bottom Line

with
AL KERTZ*

AN increased emphasis within heifer feeding management recently has been on targeted growth rates (Kertz, 2008a), improving feed efficiency, reducing feed wastage (Kertz 2008b) and limit feeding heifers (Wisconsin by Hoffman and Pennsylvania State by Heinrichs).

A group at the University of British Columbia (Greter et al., 2008) took a look at another dimension — namely, what effect does the impact of diluting the diet with straw have on heifers' feeding behavior and short-term performance?

Six Holstein heifers were used with a mean bodyweight of about 550 lb., 47 in. high at the withers and 226 days of age at the start of the trial. They grew an average of 2.14 lb. daily and 0.02 in. over the 21 days of the experiment.

Heifers were split into two pens of three. Pens had a sawdust-bedded pack area of 15 ft. x 30 ft. and a standing alley of 15 ft. x 10 ft. that divided the bedded pack from the feeding area.

Heifers had unlimited access to a total mixed ration (TMR) fed in an intake-controlled feed bin, with each heifer trained to eat from her own assigned bin. Feed was delivered each day at 0900 hours, and orts were cleaned out at 0800 hours the next day. A water bowl was available in each pen. There were two groups of three heifers fed three dietary treatments using a replicated 3 x 3 Latin square design.

The week before heifers were fed experimental TMRs, they were fed a control TMR consisting of 17% corn silage, 52.1% grass silage and 30.9% concentrate on a dry matter basis. This TMR was to provide 2.2 lb. of daily gain for a 550 lb. non-bred Holstein heifer (National Research Council, 2001).

There were three successive seven-day periods with treatments of: (1) control with no rye straw, (2) 10% straw added to the control and (3) 20% straw added to the control. The addition of straw changed nutrient levels of crude protein to 16.7%, 14.2% and 13.3%; neutral detergent fiber to 42.8%, 49.7% and 50.4%; total digestible nutrients to 69.6%, 65.7% and 64.7%, and metabolizable energy to 1.14%, 1.08% and 1.06%, respectively.

Heifers exhibited the following sorting behaviors (Table 1):

- They tended to sort against long particles with the control diet ($P < 0.07$), the 10% straw diet ($P < 0.06$) and when fed the 20% straw diet ($P < 0.01$).
- They sorted for medium-length particles ($P < 0.01$) for both the 10% and 20% straw diets.
- There was a linear increase in sorting for medium particles when straw was added.
- They sorted for short particles for all diets ($P < 0.05$) and in a linear manner.
- They sorted for fine particles on the 20% straw diet but not for the control and 10% straw diets.

The addition of straw to diets linearly decreased dry matter intake (DMI) of the heifers, along with most categories of nutrients (Table 2). There was a treatment-by-hour interaction ($P < 0.001$) for DMI, particularly for the 20% straw diet during peak feeding activity, which was right after the 0900 hour feeding. While the feeding time was greater during the daytime hours for the straw diets compared to the control diet, the control diet was consumed at a much greater rate ($P < 0.001$).

While there was a quadratic decrease ($P < 0.03$) in the number of meals the heifers consumed per day, with the fewest meals on the 10% straw diet, there was a linear increase ($P < 0.05$) in the feeding time — accompanied by a slower feeding rate ($P < 0.002$) and longer meals ($P < 0.03$) — with the addition of straw to the control diet.

These data indicate that:

- Like cows, heifers selectively consumed what they found to be more desirable in a TMR, which may result in an imbalanced diet.
- On each diet, heifers sorted against long particles and for short particles. Heifers selected for medium particles

*Dr. Al Kertz is a board-certified, independent dairy nutrition consultant based out of St. Louis, Mo. His area of specialty is dairy calf and heifer nutrition and management. To expedite answers to questions concerning this article, please direct inquiries to *Feedstuffs*, Bottom Line of Nutrition, 12400 Whitewater Dr., Suite 160, Minnetonka, Minn. 55343, or e-mail comments@feedstuffs.com.

1. Sorting[1] (%) of long, medium, short and fine particles for control, 10% straw and 20% straw added to control diets

Particle size[2]	Control	10%	20%	Linear	Quadratic
Long	92.0	91.4	87.1	NS	NS
Medium	100.7	102.9	105.5	0.003	NS
Short	104.6	103.9	110.3	0.05	0.14
Fine	96.7	103.2	107.8	0.002	NS

[1]Sorting (%) = 100 x (actual DMI of each particle fraction/predicted DMI of particle fraction).
[2]Particle size determined by Penn State Particle Separator: long = greater than 19 mm, medium = less than 19 mm but greater than 8 mm, short = less than 8 mm but greater than 1.18 mm and fine = less than 1.18 mm.

2. DMI and feeding behavior of growing dairy heifers fed control, 10% straw and 20% straw diets

	Control	10%	20%	Linear	Quadratic
DMI, lb./day	17.9	15.6	13.6	<0.001	NS
Feeding time, minutes/day	180	193	199	0.05	NS
Feeding rate, lb./minute	0.13	0.10	0.09	0.002	0.12
Meal frequency, number per day	9.6	8.4	8.7	0.03	0.03
Meal duration, minutes/meal	38.5	42.0	43.4	0.03	NS
Meal size, lb./meal	2.0	1.9	1.6	0.04	NS

Note for Tables: NS = $P > 0.15$.

when fed the 10% and 20% straw diets; these were flattened corn and short forage particles. The most delectable were the shortest particle concentrate components.

• Heifers did sort more with increasing proportions of straw in the diets. It may be their attempt to compensate for lower nutrient and energy density from straw and other forage particles.

• As with cows, heifers may have been able to and desired to sort against these larger particles as dry matter of TMRs increased from 49.3% for control to 51.9% and 54.3% for the 10% and 20% straw TMRs.

• As straw increased in the diets, the decreased DMI of heifers was most noticeable during peak feed bunk activity. This was evidenced by a slower rate of intake, even while heifers appeared to compensate by spending more time eating.

• While nutrient requirements appeared to be met for 2.2 lb. of daily gain across diets, crude protein and metabolizable energy intakes were slightly below requirements when heifers consumed the 20% straw diet.

While it appeared that heifers continued to meet or slightly miss requirements for protein and energy when straw was added to diets, this must be tempered by two factors.

First, experimental periods were seven days, which is a short time to pick up a negative effect on daily gain. Second, it is likely that gut fill would have increased, especially on the 20% straw diet since straw has a lower digestibility, a slower rate of fermentation and creates fill in the rumen that reduces DMI, as the authors acknowledged. Thus, a similar daily gain for the 20% straw diet in comparison to the control and 10% straw diets can be confounded and may not show up in the short term.

On the other hand, there are two practical implications to this study. First, heifers can and do sort TMRs as cows do. This affects formulation of diets fed to heifers, particularly when fed ingredients like straw at 10-20%. The other implication is that these heifers showed lower DMI and a reduced rate of eating when fed straw, even though they attempted to compensate by spending more time eating.

Remember, these heifers were only three in a group, and each had her own feeding bin.

What do you suppose would happen if heifers were overstocked in a large group of at least 100? I have seen group lots and freestall groups of heifers overstocked by 20-50% with no apparent concern or measurement of negative impact on DMI, growth rate, feed efficiency or cost of gain.

Based on findings of overstocking with transition cows, an increased stocking density in heifers would likely be problematic in that heifers of a lower social order would suffer by not being able to eat at the same time as the heifers of a higher social order. When heifers are only fed once daily, as is typical, the lower-order heifers would get only one chance a day to get the sorted leftovers from the reigning higher-order heifers.

The Bottom Line

Young heifers are able to — and do — sort TMRs just like cows do. As roughage levels may increase to allow *ad libitum* feeding, the reduced DMI and rate of eating need to be accounted for in the formulation and feeding in order to not short heifers on nutrients required for normal growth. Overstocking heifers in a group would compound this issue, particularly for the lower-social order heifers that are left to eat the sorted-out leftovers.

References

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