

Factors affect dairy calf growth measurements

Bottom Line

with
AL KERTZ*



SOME measure of growth is useful since calves and heifers are “grown” as replacement lactating animals, but in practice, growth is not often measured.

If a commercial calf/heifer grower is paid on the basis of pounds of gain, then a few scale weights are taken in order to establish a starting point and ending point for payment.

In larger operations, this measure may be by groups of calves, being sure calves are identified that are in the group initially so that the same calves can be measured as a group at the end point, too. This measure is based on bodyweight. On a smaller scale and with individual calves, bodyweight can be estimated by a calibrated tape measure.

What about height as a measure of growth? This can be done at the withers/shoulders or at the hips. It seems hip heights are used more now than wither heights as hip heights may be easier to take and are less variable because calves/heifers tend to stand more uniformly for hip heights than for wither measurements.

While typical height curves are based on wither heights (Heinrich and Hargrove, 1987; Hoffman, 1997), these curves can be used for hip heights by simply adding 2 in. There is also a reasonable relationship between bodyweight and wither height, heart girth, hip width and body length with R^2 of 0.902, 0.946, 0.954 and 0.981, respectively, based on linear regression from a database accumulated in 1987-90 from a variety of Penn State experiments and one commercial dairy with cattle ranging from 1 to 821 days of age (Heinrichs et al., 1992).

There were 2,625 observations for wither

*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.

Illustration of rumen fill distortion from roughage

	% roughage				
	4	16	25	31	61
Daily gain, lb.	1.30	1.32	1.03	0.92	0.70
Live weight, lb.	169	171	152	139	130
% of live weight					
Reticulo-rumen	10.0	10.8	13.6	15.3	18.4
Alimentary tract	14.7	15.4	18.6	20.4	23.3

height and bodyweight, 2,438 observations for hip width, 1,787 observations for heart girth circumference and 1,600 observations for length. Observations greater than four standard deviations from the population mean for a given measurement at any month of age were eliminated.

There is also the relationship between heart girth and bodyweight, which was established by Ragsdale and Brody (1935) with an accuracy of $\pm 7\%$ of actual heifer weights.

Another element not often recognized is the rate at which height increase occurs (Kertz et al., 1997, 1998). With heifer calves 30 in. tall at birth and 54 in. tall at first calving, 50% of that 24 in. increase is realized in the first six months of life, another 25% in the next six months and only 25% in the last 12 months before first calving.

However, what if the genetics and size of the cows are greater than this population was? I know no reason that this relationship would not be proportionately the same. Also, if you have measured and tracked individual calves younger than six months of age at regular intervals, you will have noted at times that height and weight go through episodic growth rates, just as children often are observed to do.

This is another reason why experimental or field numbers must be numerous enough and measured frequently over time so that these variations will not prevent measuring true differences (Kertz and Chester-Jones, 2004).

There are several factors that can affect growth measurements, some especially in calves younger than two to three months of age. Some of these include:

- **Level of intake.** The residence time in the gut of milk or milk replacer for a young calf is relatively short for it has a very high digestibility and relatively fast transit. Most milk or milk replacer feeding rates are between 1 and 2% of bodyweight.

By contrast, starter intake at weaning

may be 1-2 lb. daily, which, as a percentage of bodyweight, is approximately 1.5%. After weaning, when starter intakes should be 4-6 lb. daily, rumen fill will increase due to approximately 3% dry matter intake as a percentage of bodyweight from starter alone. This in itself distorts true bodyweight gain. This is also why there should be several postweaning bodyweights taken as apparent daily gains can be measured of about 3 lb. or more daily if you catch calves on the upswing of rumen fill.

- **Intake and outgo.** Since calves drink water at approximately four times their dry matter from starter, water consumption associated with starter intake before weaning may be 4-8 lb. daily, which increases to 16-24 lb. postweaning.

Additionally, timing of urination and defecation contribute to bodyweight variation. At this stage, bodyweight is around 150-200 lb. This is a relatively low number when intake for water or starter, along with urination and defecation, is relatively large relative to this bodyweight. Hence, daily gains can be quite variable and high at this time, which is why more frequent weighings and with more calves are desirable, especially for research purposes (Kertz and Chester-Jones, 2004). This bodyweight variation will decrease with age as heifers grow since dry matter intakes decrease relative to increasing bodyweight.

- **Rumen roughage fill.** Compared to calf starter, roughage/forage has a lower digestibility, slower rate of fermentation and a longer residence time in the rumen. This accentuates rumen fill and can reduce dry matter intake.

Initial feeding of roughage/forage should begin after two months of age. This is another transition time, like the weaning transition (Kertz, 2002), which can result in skewed bodyweight gains. It also can result in bodyweight gains that are not representative of true overall

growth.

A classic study by Stobo et al. (1966) illustrated how distorting rumen fill from roughage can be. These calves (Table) were weaned at five weeks and sacrificed at 12 weeks of age. Clearly, as roughage level increased, so did reticulo-rumen and alimentary tract contents as a percentage of bodyweight. Both daily gain and live weight decreased above 16% roughage in the diet.

• **Limit-fed heifers.** What happens to bodyweight gain if heifers are limit-fed? Zanton and Heinrichs (2006) fed Holstein heifers at either 579 lb. or 1,284 lb. bodyweight and either high-forage (75% corn silage, grass and alfalfa hay) or high-concentrate (75%) diets in a 2 x 2 study. Heifers fed high forage had 11.5% more wet rumen contents.

In another study (Moody et al., 2006) with 656 lb. bodyweight heifers, high-forage (77%) or low-forage (33%) diets were restricted fed with wet versus dry rumen contents being 16 and 18% lower, respectively, for low- versus high-forage diets. While not directly compared, this would indicate that restricted-fed, low-forage heifers could have the same bodyweight gains as non-restricted-fed, higher-forage heifers but, because of less rumen fill, would have truer bodyweight gain. So, how do you factor this into schemes for bodyweight gain and payment on the basis of bodyweight gain?

• **Estimators of bodyweight gain.** A hipometer has more recently been used and was compared to more traditionally available tape weights in reference to scale weights (Dingwell et al., 2006). A total of 311 Holstein heifers were used from four Canadian research herds and ranged from one week old to immediately prior

to calving (24 months). Mean bodyweight of all heifers was 575 lb. with a coefficient of variation of 47%.

Correlations between hipometer and scale weights and scale and tape weights were similar, particularly for heifers ages 3-15 months. The authors noted that this was of particular concern because groups outside this range represent ages when dairy heifers would be weaned (about three months) and when breeding would normally begin (about 15 months). This poorer relationship may partly be due to fewer heifers measured at those ages, namely 32 at younger than three months and 22 at younger than 15 months.

Now, what was missing in all of these factors in data just reviewed? If measuring true growth, there should be measures of height and maybe of length and width, too. Until there is a relatively simple method of doing this, such measures are not likely to happen.

The Bottom Line

Measuring calf and heifer growth can be problematic unless intake and rumen fill can be accommodated along with some measure of height and length/width.

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