

Metabolic feeding of calves on automatic feeders

For a long time the real effects of calf feeding have been given secondary importance by farmers as well as international researchers. The rearing of calves and heifers was primarily a cost factor that had to be optimised.

Strong focus on cost reduction had the consequence that the calves were supplied with limited amounts of milk. Today we know that the tracks for the calf's future performance are being laid at a young age and that a good supply of nutrients will lead the calf to higher achievements.

by **Holger Kruse,**
Holm and Laue GmbH, Germany.
www.holm-laue.com

The calf is still 'immature' when born to this world and many organs are not yet fully developed. For example, computer tomography scans have found that the full maturation of the lungs takes about three weeks. All the other organs show a strong development in the first few weeks of life and an enormous accumulation of cellular tissue. These organs develop even better, if the development of the calf is supported beyond the general recommended energy levels with higher amounts of nutrients.

For high performance a cow needs a well-developed udder. With this background, Brown et al (2005) have found that early udder development can be positively influenced by intensive feeding within the first eight weeks of life.

A later intensified feeding, however, had no influence. When higher amounts of energy are fed after six months of age, heifers even tend to adiposity, which should be avoided.

Soberon et al made extensive studies on the subject of metabolic programming in cattle on two farms with 1,800 cows.

Here are some examples of their results:

- Calves fed with four litres of colostrum had an increased survival rate and produced 1,027kg more milk during the first two lactations compared to calves with only two litres.
- The milk drinking phase of a calf is the period of life in which the udder tissue development reacted positively to



Natural feeding of calves – more milk by multiple feeds per day.

increasing energy supply. This later leads to more milk production.

- Ad libitum fed calves have a reduced first calving age by one month.
- For every kilogram increased daily weight gain in the milk drinking phase the animals reach an increased milk yield of 850-1113kg in the first lactation.

There are numerous other studies which come to similar conclusions.

Future recommendations

To successfully implement these scientific results into practice and thereby raise healthier heifers with better performance, the historical dietary recommendations should be revised. It should be noted that in the first weeks of life, calves can only digest milk protein and lactose. Vegetable proteins may not be digested properly because the pepsin production in the abomasum is low (max 20%).

In this phase, the rennin is predominant and is responsible for the coagulation of the milk. The period of sole milk digestion of the calf takes about four weeks. Only then can calves gradually digest vegetable proteins. This means that we need to

consider two different feeding stages in the early rearing of calves:

- **Programming phase:** The first 4-5 weeks with the exclusive nutrient supply via milk.
- **Weaning phase:** The time from about the fifth week until the end of weaning, where the digestive system has to be adapted to plant nutrients quickly.

How much energy is demanded?

According to DLG nutrition standards a calf with 50kg body weight and daily growth of 400g requires approximately 15-16 MJ ME/day. This corresponds to about six litres of whole milk or 1,000g CMR (crude milk replacer) per day.

However, if you considered the above mentioned metabolic effects, then 400g daily weight gain is not enough. The American DCHA (Dairy Calf and Heifer Association) sets in their gold standards that doubling of body weight should be the goal until weaning at eight weeks, which means a daily growth of approximately 1,000g. However, growth rates of 1,000g per day require an energy intake of about 20 MJ ME/day. This means more than eight litres

Continued on page 9

Continued from page 7

milk or at least 1,250g CMR per day. At temperatures below 10°C these values even need to be increased because the general demand for maintenance of the calves is rising.

Traditional feeding programs

Traditional feeding programs have been based on the principle recommendation of six litres per day with 120-130g CMR/l. In this case, the calf will receive only 750g CMR per day. Underfeeding the calves in energy was done on purpose to support the dry feed intake. These programs have also been used in automatic calf feeders.

But, in addition to the low concentration of energy, the automatic feeder could cause a second problem: starving of calves by missed milk feeds.

Since the total amount of milk is distributed in 4-6 visits per day, each calf receives only 120-150g CMR per visit. If a calf misses every second feed for two or three days, since it needs to get used to the feed station in the training phase, it might receive only half of the programmed 750g CMR per day.

These calves might receive not even enough energy for their own maintenance requirement and get susceptible to diseases. Thus, the supposed advantage of the many small portions on automatic feeders is also a major risk factor.

All this means that we need to redefine our view of calf feeding:

- Feeding parameters have to be adjusted to the individual needs of the calf, based on individually tailored feeding curves.

- The feeding of the calves until weaning should be divided into two phases:

- Programming phase: Intensive feeding at the time of organ maturity (first 28 days of life).

- Weaning phase: Supporting the development of the calf to ruminating animal.

- An easy measure of the nutrient and energy supply of calves in the programming phase should be defined. This could be called 'metabolic quantity'. It tells us how much CMR or dry matter of whole milk the calf has taken in until day 28 (end of programming phase). The higher this value, the higher the future potential of the calf.

To implement the findings in the programming of computer-controlled automatic feeders, every farmer should first define how intense he wants to raise his calves. Not everyone might be a fan of an intense ad libitum feeding system within the first 2-3 weeks of age. Therefore two feeding strategies can be recommended:

- **Economic feed curve**

The standard curve of calf feeders should allow a daily intake of 1,000g CMR in the first four weeks. This corresponds to the recommendations for moderate rearing



Automatic calf feeder with two Hygiene Stations.

with average growth of about 400-500g per day. This can be achieved by increasing the milk intake from six to seven litres per day during the first 14 days. With this amount we recommend a CMR concentration in the programming phase of 145g/l.

This should be reduced in the weaning phase to 135g/l. At the same time, the quantity per visit should be set to two litres. In this way 'stupid' calves which are only slowly learning to use the feeding equipment will still receive an amount of CMR of about 600g per day. At least the maintenance demand of the calf is covered.

After 35 days the calves are weaned in very small increments, so that they are fully off milk by 70 days. With this feed curve a calf would consume a total of 50kg CMR within 10 weeks.

But even more important: more than 50% of the energy (27-30kg CMR = metabolic quantity) has been consumed within the 28 day programming phase.

- **Metabolic feeding curve**

For farmers with the demand for a significantly higher milk performance in lactation, the 'metabolic feeding curve' can be recommended.

This feed curve goes without an increasing start phase and feeds 8-10 litres of milk per day right from the beginning during the programming phase. Here the farmer accepts that the calves may not retrieve the entire amount at the beginning. The concentration starts with 175g CMR/l. The daily intake of CMR or dry matter in the first programming phase is 1,400g and more. This allows the calves daily gains of 1,000g and more.

The metabolic quantity in the 28-day programming phase is approximately 38-40kg CMR. In historical feeding programs the amount was not even being fed within 10-12 weeks.

As with the economic curve the metabolic feeding curve also works with a reduction of CMR concentration before the real weaning of the calf. This prepares the

calves for a good intake of concentrated feed. The provided amount of energy is slowly reduced and the calves are feeling slightly hungry. They will then satisfy their hunger demand by an early intake of dry feed. At the same time the calves still receive a good volume of milk, which can suppress mutual cross suckling.

The metabolic feeding curve is ideal for weaning of calves that were previously fed ad lib in individual boxes or hutches. Any change to groups and automatic feeding should be done not later than within the third week of life.

When using the metabolic feeding curve, one can choose to reduce the milk phase by two weeks down to eight weeks of life.

When weaning at eight weeks, theoretical CMR consumption is about 56-60kg. Weaning by 10 weeks would result in more than 70kg CMR depending on the actual intake of milk.

Intensive feeding programs

To succeed with such programs, three important points have to be considered:

- Whole milk or high-quality, highly digestible milk replacer should be used. Lower qualities may cause diet-related diarrhoea.

- The feeding technology must be capable to feed the calves on an individual basis. The adjustments in the amount and varying CMR concentration can only be followed when each portion is freshly prepared for each calf.

- The manager and his staff must have a good eye for the calves. Despite better health, they may occasionally have diarrhoea, which can be poorly distinguished from thin liquid manure, caused by the high absorption of liquid.

Management software can be useful to analyse the feeding parameter of each calf. This software should show the manager on his PC, tablet or mobile phone which calves need special attention. ■