Acidifiers – natural growth promoters in calves

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The major goals in raising calves are to obtain an adequate skeletal growth, to avoid retarding of the rumen development and to raise healthy calves overall. The latter point is the most important and is the key to proper development and high weight gain in calves in their later stages of growth.

Acidifiers are able to support the achievement of these objectives due to the reduction of the bacterial burden in feed. This reduces the bacterial pressure in the intestinal tract in calves.

Digestive system of calves

The digestive system of calves is not fully developed at birth. In the first two weeks postpartum, calves are monogastric with the abomasum as the only developed stomach compartment involved in digestion. The rumen of neonatal calves is lacking in microorganisms. Thus, in the first two weeks, only liquid feed can be utilised effectively and hence calves are totally dependent on milk as a source of nutrition.

With time, calves develop the rumen due to the intake of solid feed and water. During the first few months of life, the digestive system of calves undergoes tremendous changes.

Hence it is not surprising that the gastrointestinal tract can be easily overworked. According to a NAHMS report, about 56% of pre-weaned mortality can be attributed to scours or diarrhoea.

Health challenges

Diarrhoea is common in newborn calves. The acute form of scours is characterised by dehydration and may even lead to death of the young animals.

In the subacute form, diarrhoea may persist for several days and result in malnutrition of calves. Various enteropathogens are associated with scours in neonatal calves.

Healthy calves have a lower number of such pathogens. Scours very often originate from more than one pathogen and hence the cause of the outbreak is multifactorial and depends strongly on the immune status of the calf. The main origins are bacterial (Escherichia coli and Salmonella spp.), viral (rota- and coronavirus) and protozoal infections.

In particular, newborn calves have a greater chance of picking up E. coli infections from the environment. Bad hygiene, polluted water and further transfer from other calves are just some environmental factors to be named.

Numerous E. coli strains exist, but at least two distinct types colonise the calf's gut and cause diarrhoea. E. coli leads to watery yellow diarrhoea, fluid loss, loss of appetite and negative energy balance.

Beside infections, feeding pattern and feed formulation also play key roles. The growth of calves is negatively affected by inappropriately formulated milk replacers which could be caused by one of the following:

- Poor quality milk replacers with heat denatured proteins.
- Milk replacer with an excessive amount of soybean or fish protein.
- Inclusion of carbohydrates not originating from milk or milk replacer.

Incorrect feed formulation may subsequently lead to scours. Nevertheless, this should not be mistaken with calves fed milk ad libitum, which leads to more watery faeces.

Treatment of scours

Treatments with antibiotics are necessary in severe cases of diarrhoea. However, prolonged and high dose antibiotic treatments can result in changes in the intestine associated with malabsorption, diarrhoea and further infections with bacteria. In the past, health challenges were largely controlled with the application of antibiotic growth promoters (AGPs).

Due to consumers' health concerns and resistant bacteria formation, several countries are moving away from using AGPs in animal production. These changes are creating the need for alternatives that help to maintain health in calves.

Acidifiers

Calves may be fed milk as well as solid feed enriched with acidifiers. Acidifiers have a

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bacteriostatic and a bactericidal mode of action when used in an appropriate dosage. Acidification could have a potentially important role in maintaining the bacteriological quality of milk fed to calves.

Adding organic acids to milk and milk products reduces pH, hence creating unfavourable conditions for pathogen proliferation and delaying bacterial growth.

Bacterial inactivation of E. coli, Listeria monocytogenes and Salmonella spp., for example, occur mostly at a pH of less than 4.5, thus a pH range of 4.0-4.5 is favourable for milk acidification.

Furthermore, organic acids are routinely added to various animal feeds to prevent spoilage and preserve the nutritional value of these feedstuffs.

Several organic acids and their salts have been known for their health and performance promoting effects.

The acidification of feed has the potential to decrease bacterial activity, hence leading to an improvement in feed hygiene and subsequently to a reduction in pathogen intake.

Reduction of bacterial pressure stabilises the gut flora and results in improved animal growth and feed efficiency.

Changes in the digestive physiology due to the initial uptake of milk and eventual intake of solid feed causes stress in calves which may subsequently lead to scours.

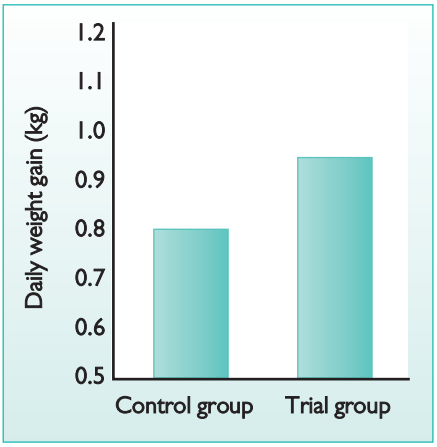


Fig. 1. Average daily weight gain of the control group and trial group with the application of a blend of organic acids, cinnamaldehyde and a permeabilising substance to counteract bacterial pressure.

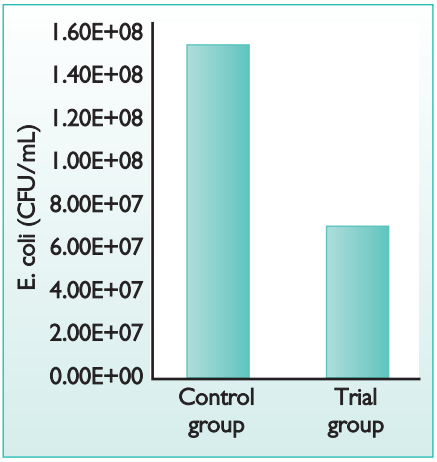
Application in the field

For determining the effects of acidifiers on health and growth in calves, two trials were conducted on different Danish farms that faced problems with scours. Calves in the first trial were, on average, 30 days old. The faecal samples for determination of E. coli counts were taken before supplementation with the mixture of organic acids at the end of the trial after 28 days.

A blend of various organic acids was further combined with cinnamaldehyde (CA), boosting the antimicrobial effects of organic acids, and a permeabilising substance (PS; Biomin Per4izer), which is able to weaken the outer cell wall membrane of Gram negative bacteria (such as E. coli or Salmonella spp.).

Calves in the second trial were up to 90 days of age at the start of the trial. The faecal samples for determining E. coli counts were taken three days after the beginning of

Fig. 2. Change in the E. coli counts in faecal samples in the control and trial group after three days supplementation of a blend of organic acids, cinnamaldehyde and a permeabilising substance.



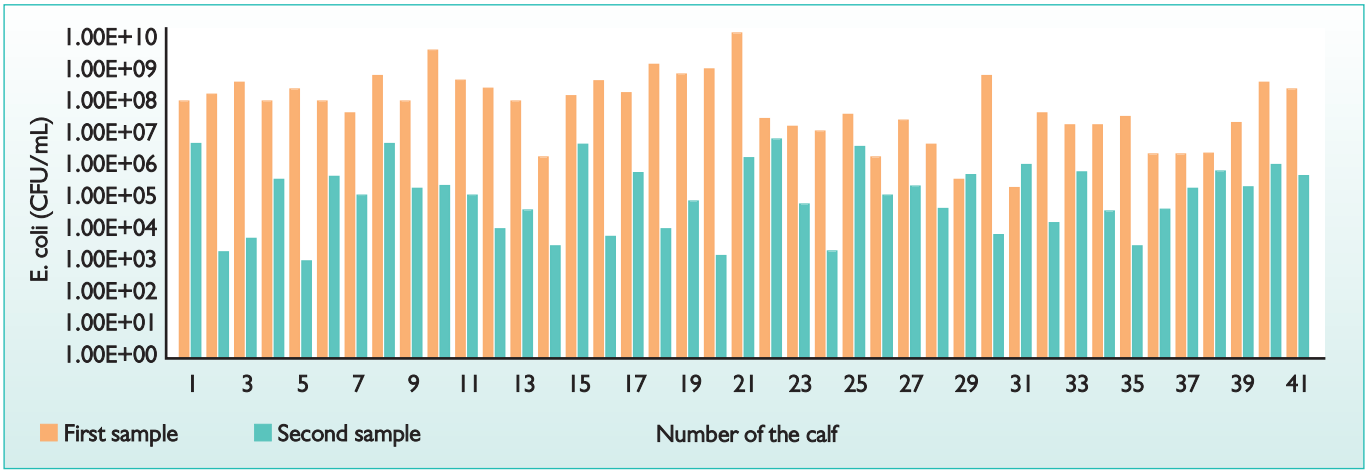


Fig. 3. Change in the E. coli counts in faecal samples of calves from two farms after 42 days supplementation of a mixture of organic acids, cinnamaldehyde and a permeabilising substance.

the supplementation and at the end of the trial after 42 days.

Feeding was similar in both trials. Calves received whole milk, starter and hay. The mixture of organic acids, CA and PS (Biotronic Top3) was added to the starter. The results of the second study showed improved growth performance in calves (Fig. 1).

Average daily weight gain was improved by 150g in the trial group (0.95kg) compared to the control group (0.80kg). E. coli counts were reduced by 0.3 log CFU/mL, which means a reduction of 50% of the bacterial count (control vs. trial group; Fig. 2). This reduction was already achieved three days after the start of supplementation with the mixture of organic acids, CA and PS.

The results of the first study showed a reduction of E. coli counts by 2.8 log CFU/mL (trial vs. control group). Thus, calves in the trial group had to face about 99% less bacterial pressure than calves in the control group after 42 days (Fig. 3).

Benefits of acidifiers

Acidifiers act on behalf of the animal and have the potential to counteract undesirable micro-organisms in milk and feed. Therefore, more nutrients are available for degradation. Furthermore, the reduction of the pH particularly favours the degradation of protein, improving nutrient digestibility.

Improved nutrient availability in the gastrointestinal tract explains the weight gain and increased animal performance overall. Increased digestibility and promotion of the animal's growth leads to a reduced mineral excretion and improved nitrogen retention, with beneficial environmental effects.

Additionally, the application of organic acids brings along economic benefits. In bulls as well as in heifer calves, economic benefits are realised mainly from lowered feed costs, decreased treatment costs and higher weight gains, not considering the positive impact on the later life of the calves.

In particular, higher feed efficiency leads to high energy supply in heifer calves, which is known to have a positive impact on milk performance in the first lactation.

Conclusion

Priority in calf raising should be given to achieving high weight gain in the first four months of a calf's life. Pathogenic bacteria colonisation in the intestinal tract impedes growth performance.

Decreased bacterial burden in the intestine can be achieved by a reduction of the pH in feeds and subsequently in the intestinal tract by the application of acidifiers.

A product consisting of different organic acids is favourable. Moreover, the combination (Biotronic Top3) of organic acids with a phytochemical and a permeabilising substance brings some synergistic effects in combating pathogenic bacteria.

Better digestibility combined with higher weight gains and healthier animals with less medical treatment positively affects the economic outcome. ■