Rumen development in calves

One of the most important aspects to consider on a dairy farm is the rearing of calves and replacement heifers. The yield of the productive life of a cow is determined in the first months of life. For this reason, it is of the utmost importance to provide the calf at birth with a clean place, to carry out a successful transfer of passive immunity by colostrum and to limit exposure to pathogens during its first days of life.

by Guillaume Olivier, Marketing Manager, Ruminant, Wisium. www.wisium.com

The cost of generating replacements is around 20% (13-25%) of the total production of a farm.

Depending on various factors, such as age at first calving, an estimated cost of a heifer at 24 months was evaluated at $US2,241 by Iowa State University in 2019.

The main goal of a calf breeding programme is to breed high-quality calves, maximising profits when they are an adult animal and enter the lactation stage. This has to be achieved at the lowest possible cost and time.

The first days of life are the most important since the gastrointestinal tract of the newborn bovine undergoes appreciable changes between birth and the moment at which the rumen becomes functional.

Factors such as quality, quantity and physical form of the diet determine the development and differentiation of the digestive system's compartments.

Access to solid feed from an early age stimulates the development of the reticulum-rumen.

The rumen structure is composed of tissue that is keratinised on the surface, and at birth multiple and rudimentary papillae measuring between 1.0-2.6mm are observed.

The texture of solid feed (particle size) affects papillary development, and, as has been reported by several authors, the finely ground solid diet would favor keratinisation of the papillae.

Transform the calf into a ruminant as soon as possible

The dairy phase is the most expensive in breeding replacements. The earlier weaning takes place, the lower cost replacement is. The main objective of this period is to make the calf autonomous as soon as possible to withdraw the milk.

The main objectives for rumen development in the first days of life are the following:

- Establish an effective microbial (anaerobic) flora.
- Stimulate rumen contractions.
- Maximise the assimilation capacity of the rumen walls.
- Ensure adequate growth.
- Limit and prevent digestive problems.
- Optimise consumption (milk and solid feed).
- Functional rumen that is ready for weaning.

Rumen development

The rumen at birth is sterile and non-functional, at weaning the rumen must have an anaerobic rumen flora that produces volatile fatty acids (VFA), in addition to having an absorption capacity, motility and contractibility. There is some controversy about the type of solid feed that should be included in the diet of calves during the period before weaning.

The final products resulting from the fermentation of the starter feed in the rumen are predominantly butyrate and propionate. Butyrate has been shown to be the VFA that stimulates the greatest growth of rumen mucosal papillae.

However, feeding only starter feed before weaning calves can reduce rumen pH, decrease rumen motility, and cause hyperkeratinisation and agglutination of rumen papillae; therefore, decreasing the mucosal capacity of the rumen to absorb nutrients, especially if the starter feed is finely ground.

On the other hand, forages stimulate the muscular layer of the rumen, promote rumination, and maintain the health of the rumen wall. The supply of only forage to calves younger than 60 days of age is not recommended because it has been shown to reduce feed consumption in individually housed calves, impair the development of rumen papillae, as well as decrease digestibility, daily body weight gain and dry matter consumption.

In addition, cellulolytic activity in the rumen of young calves is not fully acquired until three to four weeks after birth, suggesting that forage consumed before three weeks of age may not be digested properly.

This leads to a technical problem since the addition of fodder provides fibre and supports intestinal health, but on the other hand it limits growth.

Managing the transition to solid feed

The intake of concentrates and water are the most important factors for rumen development. Some recommendations must be followed in order to have a successful transition and weaning.

The calf starter should be offered from day one, as a pellet or coarse feed with high palatability. As we saw above, the particle size of the starter ingredients is very important with a minimum of 1.19mm.

According to Church et al., (2003), concentrates of very thick texture or tablets are more desired than the flour type. In case of offering finely ground concentrate, it will cake in the mouth of the calf and cause it to shun the feed, while the grains have good acceptance when they are broken or crushed, and if they are treated with steam, they can be even more desired.

The formulation of the starter feed is also a major challenge for the nutritionist. The supply of starch and sugar (grains) is important for the production of VFA, which is necessary to stimulate the development of rumen epithelium.

However some starters with high digestible fibre content, which contain raw materials rich in NDF (neutral detergent fibre), can be a very safe option since it promotes the establishment of cellulolytic flora and generates a more alkaline pH, without generating acidosis problems and obtaining easy digestion.

Forages are a good source of fibre, promoting the growth of the muscular layer of the rumen. To note, good quality and palatable forage is highly recommended. This should be offered in addition to starter feeds frequently and in small quantities in order to ensure freshness and good intake.

Water is also fundamentally important to rumen development. We know that milk goes directly into the abomasum, but water goes into the rumen. The digestion of 1kg of calf starter requires 3-4 litres of water. It is necessary to support the rumen microbial population and promote good rumen function.

In conclusion, it is very important to have a good feeding strategy for the rearing of calves, otherwise the future profitability of the farm can be negatively impacted. One of the key aspects is to ensure good development of the digestive system and transform the calf into a ruminant as soon as possible.

The distribution of starter feeds, water and good quality forage is imperative to promote this transformation. Wisium, ADM's global premix and services brand, has developed Nursy, a calf breeding programme including all this knowledge and recommendations in order to achieve the goals of the farmer.

The Nursy programme combines Newean milk replacers, specific starter feeds and nutritional supplements, providing optimal nutrient levels, always prioritising rumen development and intestinal health, so that calves have the ability to develop as ruminants at an earlier age. ■

References are available from the author on request