

Laying the foundation for immunity in calves

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Calf immunity is much more than colostral immunoglobulins and vaccines. Immunity against disease is the calf's ability to fight disease and remain healthy and this is influenced by diet, environment, and management.

A holistic view of calf immunity will result in healthy and thriving calves, with optimal growth and development for future dairy production. Calves should be raised with the same care and attention a prudent mother gives her child, protecting it from harm and providing optimal nutrition throughout its life. The aim of this article is to look at the key components that allow a calf to stay healthy and develop into a high producing dairy cow.

Disease protection is warfare against pathogens that attack the calf. Just as in warfare, the enemy will try to break through the defence at its weakest point. Defence requires a lot of energy and one never wants to fight the enemy on two fronts or with depleted resources.

The major battles in calf health are fought in the gut and the lungs. Immunity is like defence, it needs to be built up in times of peace, to prepare for potential war. The war may never happen, but if it does, inadequate defence will mean morbidity and mor-

talidity. Often we focus on the enemy, when the focus should be placed on the lack of defence. Most research suggests that intestinal and respiratory infections are responsible for the majority of disease and deaths in young calves.

However, in terms of improving calf health, the focus needs to shift from the pathogens to the calf's own immune system. That said, measures of immunity are sometimes difficult in commercial settings. Generally, sick calves do not thrive and, therefore, measures of productivity are indirect measures of immunity.

The calf's immune system involves acquired, passive and active components. Acquired immunity in the calf is almost entirely via colostrum. Passive immunity involves the integrity of the skin, mucosal and lung surfaces and the gut. The direct immune response is classified into two main categories:

- Antibody-mediated immunity via immunoglobulins.
- Cell-mediated immunity through white blood cells (WBC).

Some WBC (B-cells) produce antibodies that bind to the surface of pathogens either destroying their ability to invade the body or making them more visible for other WBC to destroy. White blood cells that mature in the thymus gland (T cells) are active in cell-mediated immunity – they activate other

cells that cause direct destruction of pathogens or assist B cells.

These immune responses develop in the first few weeks of life and, during this time, it is essential that the calf receives passive transfer of immunity from the dam through colostrum.

Immunity starts before birth

A strong calf is created in a healthy and strong cow. Colostrum quality is influenced by the dam's pre-calving nutrition and micronutrition. Selenium is involved in supporting the immune response and using organic selenium instead of sodium selenite in the dam's diet results in an improved immune response. Organic selenium (Sel-Plex, Alltech Inc, KY), given to pre-calving heifers and cows provides an increased selenium status for dams, as well as their calves through increased selenium concentration in colostrum and milk. Supplementation with mannan-oligosaccharides (Bio-Mos, Alltech Inc, KY) has also been shown to improve immune response to rotavirus vaccination.

A difficult calving will influence the calf's ability to absorb colostrum consequently impacting its immunity. Anoxia, as well as stress may also negatively impact the newborn calf. It is important that the calf is born in a clean, draught free and dry environ-

ment. Do not let your calf start its life with a mouthful of manure.

Despite the knowledge regarding the importance of colostrum, surprisingly many producers fail to ensure that calves have received sufficient quantity and quality. Failure of passive transfer (FPT) remains a common phenomenon globally. Several studies have indicated that in the range of 40-45% of USA heifer calves had FPT.

Although FPT calves can survive, in times of stress and disease challenge, they are much more likely to succumb to disease. One study indicated that during heat and disease stress, 50% of calves with FPT died.

Nutrition for immunity

The calf is born with limited energy reserves and requires sufficient daily energy and nutrients to develop a strong immune system. Many studies indicate that milk replacers cannot compete with cow's milk with regards to nutrition. A study by Godden et al. (2005) indicated that calves receiving pasteurised cow milk compared with a 20% protein/20% fat milk replacer had 62% less disease treatment, 80% less mortality and 34% increased weight gain.

When using a calf milk replacer, a good investment is to use one with high protein/high fat including dairy source proteins. It is not simply quantity and composition of milk feed that influence calf health.

A recent study, where calves were fed the same quantity of milk divided over two or three daily feedings, demonstrated that calves receiving feed three times daily were more likely to enter the milking herd, calved 16 days earlier and averaged 515kg more milk during their first lactation compared with calves fed twice daily.

Enteric disease and immunity

Local gut immunity composed of microflora, intestinal lining, mucus and local immune responses involving antibodies and leucocytes contributes to a healthy calf. Rota and corona virus, *Escherichia coli*, *Cryptosporidium parvum* and *Salmonella enterica* are often found in young calves and may or may not be associated with disease.

When a calf has diarrhoea the pathogen identified in a diagnostic test may not necessarily be the cause of the disease – diarrhoea is a multi-factorial disease combined with inadequate gut immunity. Integrity of the intestinal lining and healthy gut microflora are key components of gut immunity. Mannan-oligosaccharides (such as Bio-Mos and Actigen, Alltech Inc, KY) can support gut function by preventing disease-causing bacteria attaching to the gut, supporting the beneficial bacteria, increasing the intestinal mucus layer and improving local and systemic immune function.

A recent Polish study indicated that Bio-Mos supplementation in the milk feed can

improve faecal consistency, immunoglobulin concentration, increase concentrate intake and improve feed conversion thereby improving weight gain.

Environment and management

Calves exposed to transportation, adverse weather conditions or other stressors may have impaired immune responses. Stress hormones interact with most aspects of the immune system and can dramatically depress calf immunity. The young calf should be housed in an environment that is draught free but well-ventilated and protected from adverse conditions, such as excess heat,

cold or rain. Pathogens, such as enteric bacteria and cryptosporidia, can build up in the calf's environment, especially with sick calves shedding high levels of bacteria, viruses or oocysts. The calf environment should be cleaned regularly, soiled bedding removed and cleaned between groups of calves. In conclusion, the ability of the calf to mount an effective immune response at an early age greatly influences early disease and survival but also future performance.

The basis for developing a healthy and immune-competent calf starts with the dam and thereafter embraces a holistic approach to all aspects of calf care, including calving, colostrum, nutrition, housing and management. ■