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**Feeding the Immune System: Perspectives from the Feed Additive Industry**

The body of science of animal nutrition has entered a new era in which the collective understanding and synergies of other biological systems, has become critical to future advancement. Nutritionists of today and the future must work within an understanding of other biological systems, including the immune system. This requirement presents opportunity to change nutritional applications and offers the feed additive sector, product development opportunities.

When considering the immune status of a production animal, there are two avenues of consideration for practical nutrition. The first of these is the plane of nutrition. The understanding of the energetic requirement for an immunological response, and associated nutrient repartitioning, has been modelled well in recent years (Kvidera *et al.* 2017a; Kvidera *et al.* 2017b). For example, work by Kvidera *et al.* (2017) has demonstrated that the Holstein cow requires >1kg of glucose for a 12 hour active immune response induced by lipopolysaccharide (LPS) infusion (Kvidera *et al.* 2017a).

Feed additive approaches can be further split into categories. For example, there are direct impacts of postbiotic ingredients. In 2021 the International Scientific Association of Probiotics and Prebiotics (ISAPP) proposed the following definition for the term postbiotic: ‘a preparation of inanimate microorganisms and/or their components that confers a heath benefit on the host’ (Salminen *et al.* 2021). Previously the yeast product (non-living yeast ingredients) sector has discussed, at a commercial level, the potential benefits to immune support, however it is only recently that postbiotic modes of action are being characterised both *in vitro* and *in vivo.*

Postbiotic functionalities could be considered as a direct impact however there are some feed additives that could be considered to have an indirect impact. Considering the increased demand for energy at times of stress and during an activated immune response, enzymes, allowing for improved nutrient availability, have a role to play in meeting increased energy requirement within a limited dry matter intake (DMI) of fresh cows. In the same way, silage additives, which improve fermentation profile of ensiled forages, also offer opportunity for maximising nutrient availability per kg of forage DMI (Muck *et al.* 2018).

A third category of feed additives is better described as a mitigator of potential inflammatory challenge. Both mycotoxins and endotoxins present a challenge to the production animal. The endotoxin challenge is particularly relevant to ruminant nutrition due to the physiology of ruminant animals (McDaniel *et al.* 2023).

As the scientific frontiers of nutrition and immunology begin to close the gap, the commercial nutrition industry must become technicians of their application. This paper will present a practical understanding of how this can be applied, and how product development is being influenced.

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