

<https://marketing.feedinfo.com/interview-evolving-understanding-of-rumen-acidosis-opens-new-possibilities-for-detection-and-management/>

## INTERVIEW: Evolving Understanding of Rumen Acidosis Opens New Possibilities for Detection and Management

**19 December 2018 – When the 10th edition of the International Symposium on the Nutrition of Herbivores (ISNH) came to Clermont-Ferrand, France, Lallemand Animal Nutrition seized the opportunity to start a discussion about an important topic within ruminant health—acidosis. Acidosis is both widespread and, particularly in its sub-acute form, often undetected. Estimations cited by Lallemand conclude that acidosis could be costing intensive ruminant production operations between \$1 to \$4 per head daily, including reduced production output as well as health and reproduction problems associated with the disease.**

Moreover, as was pointed out by one speaker, the topic is gaining attention among researchers; it is estimated that the number of reports published on the topic reached as high as 1,500 last year. Bringing together experts in OMICS, diagnosis and modelling, feeding management, feed additives, cattle behavior, and gastrointestinal physiology, Lallemand's side event, the International Acidosis and Rumen Health Satellite Conference, painted a picture of acidosis as a condition which is considerably more nuanced than previously believed. In an interview with Feedinfo News Service, Laurent Dussert, Lallemand's global category manager for ruminant feed additives explains why this is the case.

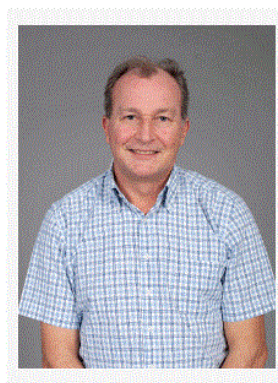
### **Beyond average pH**

First, as he says, we have gone from a simple understanding of acidosis as a function of pH to a more multi-faceted approach. Even when it comes to measurements of pH, he says, large fluctuations in pH are also an important indicator granting a more dynamic picture of the situation beyond merely the average pH, as a study by France's INRA with the support of Lallemand demonstrated in a recent paper<sup>1</sup>.

However, pH is not the whole story. Acidosis can also be understood from a mechanistic point of view, he says, pointing to the satellite conference presentation of Gregory Penner, which discussed how acidosis deteriorated the conditions of the rumen and challenged the barrier function properties, leading to a local immune response. As Dussert says, "we are only starting to get an overview of the functions of the digestive wall for cattle, taking into consideration the rumen and even beyond, including the lower gut." Thanks to new research which provides a greater understanding of what goes on in the post-rumen hindgut, Dussert thinks we will increasingly start to talk not only about ruminal acidosis but gut acidosis.

Understanding these various dimensions are important in developing novel ways both to avoid acidosis and to mitigate the damage. For example, Dussert points to a study<sup>2</sup> published at the end of 2017 carried out in cooperation with Catalonia's IRTA (Institute of Agrifood Research and Technology) which made innovative use of an endoscope via the rumen or the colon to study the gene expression, histology and microbiology of the different digestive compartments in vivo during the change in diet accompanying the transition of a cow. In his words, this study gave new insights about how certain strains of live yeast—namely *Saccharomyces cerevisiae* CNCM I-1077—is able to limit the risk of high rumen wall permeability also leading to an inflammation.

"It's kind of a revolutionary research tool which helps to bring innovative information about this aspect of acidosis. It's not just the pH any more." Altogether, it is now



**Laurent Dussert**  
Global category manager-

understood that a high concentrate diet induces damage to the rumen wall, namely a decrease in rumen epithelium thickness, increase in lesions, papillae erosion, and tight junction genes down-regulation. As this takes place, inflammatory molecules such as LPS endotoxin or histamine can be translocated to the blood stream and trigger an inflammatory response.

Ruminant feed additives  
Lallemand Animal Nutrition

### Microbial shifts

This is both fed by and contributes to shifts in the microbial environment. Again, Dussert says, new technology is opening up new avenues for understanding this disease. "About 20 years ago, we could detect less than 20% of the microbial population [mostly in the rumen]; today, the new tools based on METAGENOMICS [including transcriptomics and metatranscriptomics] help to detect both known and unknown microbial populations," he states.

His colleague Dr. Frédérique Chaucheyras-Durand, research manager for rumen microbiology based at INRA-UCA in Clermont-Ferrand, shares more about what this means for tackling acidosis. Pointing to studies carried out over the previous few years, she says *Megasphaera elsdenii*, an important lactate-utilizing species, has been confirmed to be a key species in preventing sub-acute rumen acidosis and metagenomics analyses have shown that *M. elsdenii* genes are enriched in efficient cattle. Other work has helped understand the roles of different members of the microbial community in contributing to digestion, such as fungi and protozoa populations which contribute to fiber degradation to a much greater extent than previously thought. As Dr. Chaucheyras-Durand explains, since these populations are very sensitive to low pH, it is easy to understand how fibrolytic activities can be depressed. Finally, she says, we are increasingly able to explain how periods of high stress might affect acidosis occurrence; for example, during calving, there is an increasing SARA risk because of the greater abundance of *Streptococcus* and *Lactobacillus* in the rumen post-partum, as well as of *Proteobacteria*.

### Behavioral changes and management

And of course, acidosis is associated with behavioural changes, including lower feed intake and changes in locomotion. These serve an important role in alerting farmers to the existence of a problem. Dussert points out that detecting these behavioural changes will be increasingly possible thanks to tools such as sensors or collars to monitor feed intake and rumination, pedometers to measure movement, and digital cameras. However, conventional field observations, if done systematically, can be an invaluable detection tool as well. For that, the company has developed a set of nine criteria for a rumen efficiency investigation, to help the dairy and beef industry identify the risk of acidosis in individual cases, using elements such as manure consistency, cleanliness of hind region, locomotion, and body condition. This is an important step in helping to make sure that the advances researchers are making in understanding the dynamics of acidosis are being linked in useful ways to practices and applications in the field, one of the most important challenges on the acidosis front today in Dussert's opinion.



**Dr. Frédérique Chaucheyras-Durand**

Research manager,  
Rumen microbiology  
Lallemand Animal Nutrition

As was stressed by different speakers at the Satellite Conference, addressing the all-too-prevalent condition requires attention to several elements of animal feeding. Alex Bach, a research professor at IRTA-ICREA in Catalonia, Spain observed that particularly close attention must be paid at sensitive transition times when the diet composition is changing, for example when a dairy cow is transitioning from dry to lactating or an animal raised for beef is going from growing to fattening. Understanding why and when animals binge on rapidly fermentable carbohydrates is an important part of the fight against acidosis. Producers must space meals, and be attentive to feeding behaviours during hot days when animals might delay eating until cooler temperatures in the evening. Other risk factors he calls out include farms where cattle have no access to leftovers and those with high stocking densities: both "may cause cows to slug-feed and compete for feed." Moreover, Bach points out, it is important to confirm that the diets that have been carefully formulated actually reach the animals. Serving rations cut small enough to avoid

sorting is key, as is adjusting for moisture content in silage (as this can fluctuate, causing the amount of fibre and nutrients in the final ration to deviate from what nutritionists had intended to deliver).

Feed additives also play an important part in maintaining ruminal balance to avoid acidosis. Helen Golder, Research Director of Scibus in Australia, took the conference's attendees on a tour of the current landscape. Antibiotics, of course, have long been used to ensure ruminal balance, but producers in many parts of the world are being compelled to reduce their usage. Buffers are also widely used for controlling acidosis, while direct feed microbials [DFM] show promise, although Golder notes that results are not always consistent (and Dussert explains that DFMs are also hampered by their limited shelf life, and in many cases only the largest operations are equipped to manage handling and deployment of DFMs). Finally, there are specific live yeasts, which may improve rumen pH, reduce pH variations, and reduce lactic acid production through its interactions with endogenous rumen microbiota, increasing the populations of acid-consuming bacteria and reducing the number of lactic-acid producers. Interestingly, most of these substances also provide other advantages in an animal's diet; in the case of live yeast, the non-acidic, anaerobic environments which yeasts create also promote the development and activity of the endogenous fibrolytic flora in the rumen, increasing feed efficiency. "Optimal pH can be linked to optimal fibre degradation, and this offers a higher release of energy from forage that can be translated into milk or meat," Dussert observes. This is driving a transformation in why farmers are using live yeast: whereas ten years ago, it was mainly seen as a tool to combat acidosis, today's market surveys show that reason is tied with an interest in improving feed efficiency, he claims.

Lallemand sees its own role as located at this intersection between the lab and the farm—not only actively participating in carrying out theoretical research to better understand the biochemical interactions driving acidosis, but also translating them into solutions that are practical to implement on the farm. As Dussert explains to Feedinfo, better management of acidosis will lead to predictability for farmers. It helps resolve the mysterious differences which result in performance which is lower than expected for a given level of input. "For Lallemand, it's investing in understanding what's happening in the microbial ecology, what's happening in the rumen wall histology, and by understanding what happens, we can better propose solutions." He is hopeful that a wider view of the various ways acidosis can affect multiple systems within an animal, combined with novel devices to observe these changes, will allow the industry to meet demands for animals which are more predictable, more robust across varying climactic conditions, and even more comfortable, all of which will be more and more important for the future.

---

1: Villot, C., et al. "Relative Reticulo-Rumen PH Indicators for Subacute Ruminal Acidosis Detection in Dairy Cows." *Animal*, vol. 12, no. 03, 27 July 2017, pp. 481–490., doi:10.1017/s1751731117001677.

2: Bach, A., et al. "Changes in Gene Expression in the Rumen and Colon Epithelia during the Dry Period through Lactation of Dairy Cows and Effects of Live Yeast Supplementation." *Journal of Dairy Science*, vol. 101, no. 3, 2018, pp. 2631–2640, doi:10.3168/jds.2017-13212.

---

By Simon Duke | December 19th, 2018

---