

The importance of normal intestinal health in dairy cows

When it comes to dairy cows and ruminants in general, the focus tends to go immediately to the rumen. Problems like metabolic diseases, inflammation, poor performance and non-satisfactory reproduction indexes are immediately linked to the functionality and health of this organ.

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However, recent studies suggest that in ruminants a healthy intestinal function is a fundamental part of successful farming. Every action targeting gut health and normal intestinal function is greatly paid back by increased milk efficiency.

The three fundamental cycles in the dairy cow

The life of a dairy cow moves around three fundamental cycles which last 24 hours, 12 months and two years respectively.

In 24 hours, a dairy cow performs the main important activities of its everyday life: eating, milking and resting. These activities should follow one after the other without interruption as any delay in this scheduled sequence represents a waste of time and a potential threat for health and productivity in the long run.

The second cycle lasts 12 months and comprises two phases: the dry period with an ideal length around 45-60 days and the lactation phase which covers the remaining days of the year.

To keep efficient productivity, each milking cow should maintain the sum of the two phases inside the time frame of one calendar year. Any elongation of this period represents a loss of efficiency.

Poor management or sub-clinical

and metabolic diseases are the cause of the lost timing.

The basis of good longevity is regular alternation to the dry and lactation period to permit the cow to prepare for the incoming lactation and to avoid excessive body condition. Finally, the third cycle is the one that lasts two years. These 24 months are the time needed for a calf to grow and pass through the different phases of calving, weaning, reaching puberty and delivering its first calf.

Keeping the three fundamental cycles in frame: 'mission impossible'?

The three cycles represent a target for all milk producers as they are a warranty in the sense that – if these times are respected – the farm will most probably stay healthy and efficient. However, nutritionists and veterinarians are highly aware that this is not an easy task and often a high number of cows have cycle times longer than these.

If the lactation period is longer than needed, cows will be at risk of gaining excessive weight with dramatic consequences for fertility and productivity of subsequent lactation periods.

In the same way, delayed puberty in heifers will bring an additional heavy cost to the farm.

Additionally, there is a missed opportunity if calves are not growing at the expected fast pace during the wet period since this is the moment when epigenetic imprinting can make them more productive cows.

We also know that although there has been a strong genetic selection in the past decades, a relative high degree of variation in performance still exists within each farm.

Consequently, on any given farm most of the animals perform according to the genetic potential, while some individuals are overperforming and some are underperforming according to the standards (Fig. 1).

In case the three cycles are not respected, the distribution will be kept as normal but will move dangerously toward a zone of less

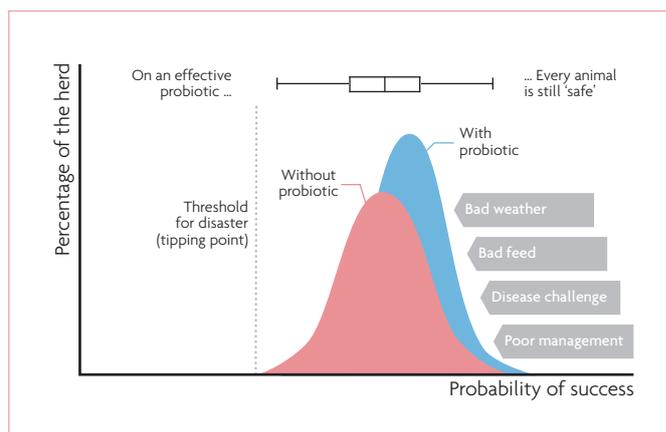


Fig. 1. The bell curve and tipping point concept.

performance which can end in a non-return point.

There are many factors that can upset these perfect timings. The genetic improvements have created animals that are extremely productive and efficient but at the same time bring with them an extreme fragility linked to the high metabolic activities needed to maintain the high production.

This calls for an upgrade of the management and nutrition as well as for a more comprehensive understanding of the needed priorities of the animals.

In light of this, the challenge for modern farms is to ensure the full expression of the genetic potential of the animals in order to keep them in a normal state.

'Normality' is the winning word for the success of modern cows. From a practical point of view the target is no longer to maximise the performance but rather to create all the conditions that ensure the animal can stay in a normal state. If we can respect the cow's needs she will largely pay back our efforts.

The key question is how to make this possible?

Intestinal health is one of the priorities

The life of a cow is not easy as many factors are challenging the normal status: for example toxic substances,

the quality of feedstuffs, and bunker management. A non-exhaustive list is shown in Table 1.

The rumen has an important function in this regard as it can buffer, but also be affected by, many of these factors. However, the picture is not complete if we do not factor in the role of the intestine in

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Table 1. Some of the factors that can put the intestine under pressure.

- Variability in feedstuffs
- Administrational factors present in the feedstuffs
- Mycotoxins (DON, ZEA, FRUM)
- Enterobacteria (E. coli, clostridium, salmonella)
- Poor digestibility of single ingredients or of all diet components in relation to the age of the animal
- Water quality and TM hygiene
- Poor preservation of feedstuffs (moulds and bad fermentation)
- Mistakes in feeding preparation and management
- Sub-Acute Ruminal Acidosis (SARA) with related intestinal inflammation

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the equation as reported by a recent research study.

Both the small intestine and the hindgut have a complementary activity to the ruminal function.

In fact, they facilitate digesta passage, nutrient digestion, nutrient absorption, barrier function, luminal nutrient sensing and host-microbial communication. The regulation of these functions is complex, but all these functions are essential for a balanced gastrointestinal tract function.

The intestine plays an important role in the immune function of ruminants. Some 70-75% of the immune cells reside in the intestinal tract which makes this organ the first and most exposed line to immune stimuli and challenges.

Activation of the immune system is a process that ensures animal survival as it confers the capability to fight diseases but at the same time its activation is extremely costly in term of energy and nutrients.

The proper immune stimulation – particularly in the early stages of the life of a calf – at the intestinal level will have an impact on performance and efficiency as well.

The intestine is host to a complex and diversified microflora and having the optimal nutrient composition and biochemical conditions is essential for facilitating optimal growth of beneficial commensal bacteria.

However, in some situations (many of them generated by events present in Table 1) the intestine can also be the perfect incubation place for a fast multiplication of pathogenic and potentially foodborne disease-causing micro-organisms.

The barrier function of the intestinal mucosa is of paramount importance in this regard as it separates, selects and manages the contact between the intestinal content and the internal blood and tissues.

In case of an excessive permeable mucosa (a condition known as 'leaky gut' Fig. 2), the barrier function is compromised and this may cause

noxious bacteria, toxins and molecules bearing excessive immune stimulation properties to enter the bloodstream.

This is a condition that has recently been confirmed in a scientific study by Kvidera et al., 2017.

Direct feed microbial can help

Beneficial bacteria are known to support healthy intestinal function and preserve mucosal integrity. *Lactobacillus animalis* (LA51) is a probiotic strain proven to improve gastrointestinal (GI) health in cattle, in part by reducing the burden of *E. coli* and salmonella.

In a recent study presented at ASDA in 2019 the efficacy of LA51 has been tested in an in vitro model mimicking a leaky gut situation generated by a challenge with *S. typhimurium* (DSM 19587).

The test measured Trans Epithelial Electric Resistance (TEER) and FITC-dextran (FD) translocation across a single layer of intestinal epithelial cells as two indicators of intestinal cell looseness and leakiness.

S. typhimurium caused a dose-dependent TEER decrease, inversely correlated with increasing FD translocation.

LA51 significantly reduced the TEER decrease by 50% (Fig. 3) and the amount of FD translocation. In conclusion, LA51 confers protection against intestinal pathogens counteracting their damaging effect on intestinal integrity.

Every animal, every day, every year

Maintaining the normal function and condition of the intestine of dairy cattle must be a high priority for milk producers considering all the challenges that calves, heifers and cows are subjected to every day.

The loss of normal function can happen not only in case of severe situations but can be a sum of small mistakes and variations that

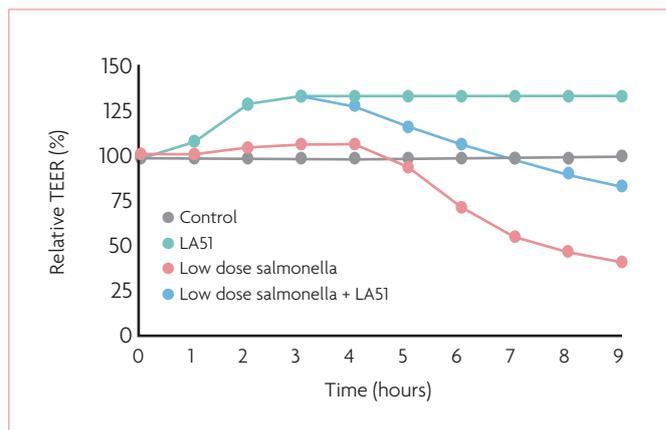


Fig. 3. Positive effect of *Lactobacillus animalis* (LA51) on gut integrity in the presence of an *S. typhimurium* challenge.

characterise the practical life inside the farm. Sub-Acute Ruminal Acidosis (SARA) has been a major focus as a causative factor negatively affecting gastro-intestinal health.

Ruminal acidosis creates the condition of having excessive amounts of feed flowing to the intestine with a potential risk of overfermentation from the intestinal bacteria.

This will generate intestinal inflammation and increased mucosal permeability or 'leaky gut'. However, it should be acknowledged that other factors such as low feed intake or rapid dietary transitions may also compromise the absorptive and barrier function of the gastro-intestinal tract.

For example, when animals are subject to restricted feed versus ad libitum dry matter intake, there is a dose-dependent reduction in absorption of volatile fatty acids (VFAs) across the reticulo-rumen, along with an increase in permeability of the total gastrointestinal tract. It is not unusual to visit farms and spot some groups of animals with an empty bunker for some hours.

This can also happen in case of transitioning dairy cattle, particularly those experiencing metabolic diseases (hypocalcaemia, ketosis) or infectious diseases (metritis,

mastitis). They may experience dry matter intake reductions of 75% with the related intestinal increase in permeability.

The same issue can happen in milk-fed Holstein calves. Some studies reported an age-dependent decrease in the permeability throughout the gastrointestinal tract which can be disrupted by weaning time with weaned calves having markedly greater intestinal permeability than calves that were not weaned later.

Also, the delay of milk supplementation – with the risk of missing the optimal temperature at which milk should be provided – can reduce or dramatically change nutrient supply, including supplies to the gastrointestinal tract, which may also compromise gut functionality.

Quality of life is determined by many factors

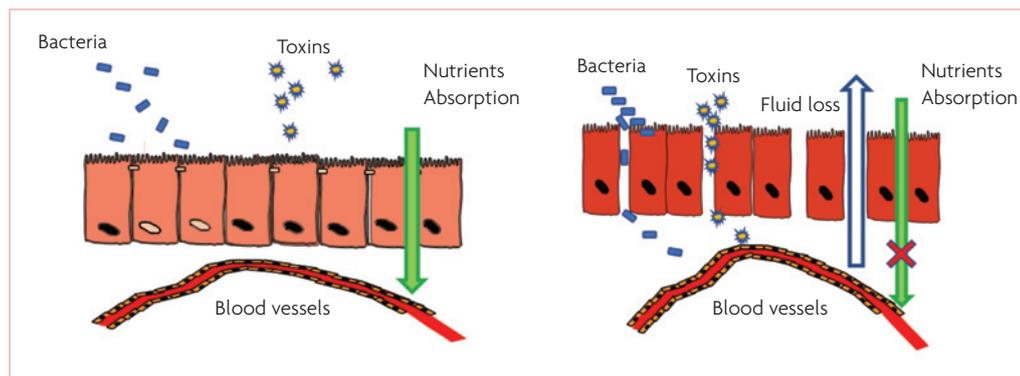
All these examples point to the fact that life quality on the farm is determined by many factors and by the extreme variability of the conditions of the animals. This is the situation in which dairy cows are living although they have a natural high preference for stable and normal conditions.

Direct Feed Microbial (DFM) of the family of *Lactobacillus* (LA51), *Bacillus* (CH200 and CH201) and *Enterococcus* (M74) have been proven to be an efficient tool to ensure good farm efficiency, contributing to sustaining health and normal intestinal function.

The secret of the successful use of these bacteria rely on the knowledge that the presence of continuous challenges faced by farmers calls for continuous support.

That is why the best return on investment happens when we supply DFM every year, in every animal, every day. ■

Fig. 2. Healthy intestinal mucosa versus leaky gut situation.



References are available from the author on request