Enhancing poultry digestive microflora from the inside-out

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A statement that has been around for a while now is the fact that 'an animal lives around its microflora'. This is true for poultry as performance is linked to the good functioning and efficiency of the gastrointestinal tract (GIT), the site where feed is broken down and nutrients absorbed to be further converted into meat or eggs.

However, the bird is unable to do the job all by itself: part of the digestion work relies on the activity of the digestive microflora, a rich, complex, and evolving ecosystem. This microflora plays an essential role in the digestion of certain feed compounds, but also in detoxification of certain molecules, and protection against potential pathogenic bacteria thanks to a true 'barrier effect'. But, this ecosystem is constantly evolving, with its 'bad' and 'good' elements.

Therefore, keeping this ecosystem balanced is a key to digestive health and performance.

This in turn improves animal performances and well-being, which ultimately positively affect quality and safety of the end products of eggs and meat.

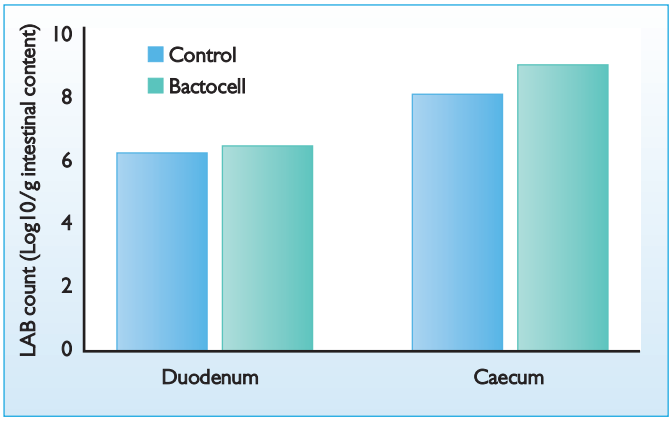


Fig. 1. Lactic acid bacteria count in different segments of the gastrointestinal tract for control and Bactocell treated birds after at least seven weeks of supplementation (Temin et al 2009, Vittorio et al 2005).

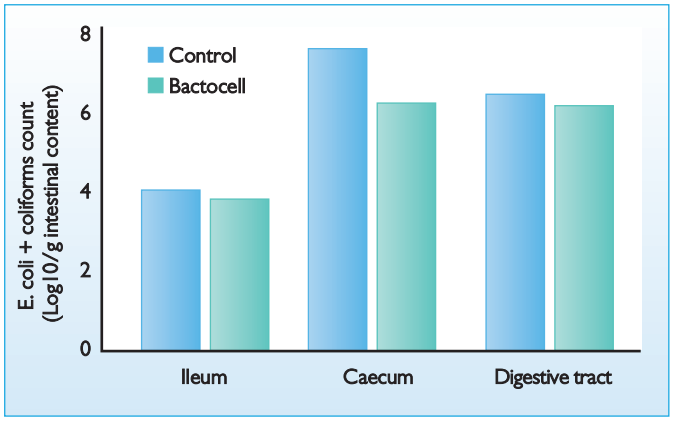
Benefits of probiotics

Probiotics are recognised as a help to manage the digestive microflora balance and enhance feed digestion. Lactic acid bacteria (LAB) strain Pediococcus acidilactici MA 18/5M (Bactocell), has been widely documented for its proven positive effects on poultry digestive function (notably through the enhancement of gut maturity and feed digestibility), but also on digestive microflora balance.

This latter effect is due to several properties of this specific live bacteria strain. Indeed, bacteria have specific needs for growth and different bacteria will have different optimal growth conditions: lactobacilli, some of the 'good bacteria' of the gut, thrive under a pH of around five, while most pathogens prefer higher pH.

As the live bacteria cells contained in this product produce high concentration of lactic acid inside the gut, this induces a local pH decrease in the mucus layer surrounding the villi, thus creating a favourable micro-environment for the development of beneficial bacteria and putting hard pressure on potential pathogenic bacteria.

Fig. 2. Total E. coli/coliforms count in different segments of the gastrointestinal tract for control and Bactocell treated birds after at least six weeks of supplementation (Taheri et al 2010, Vittorio et al 2005, Guillot et al 1994).



This effect on digestive microflora has been illustrated in several field studies, in particular:

- Guillot (1995) has shown that Bactocell supplementation in broiler chickens speeds up the installation of lactobacilli in the digestive tract.
- This product also improves the lactobacilli/coliform balance in various parts of the digestive tract (see Figs. 1 and 2).

Assessing gut microflora

If it is very interesting to analyse gut microflora composition in field trials and commercial farm settings, for example to evaluate the hygiene status of a farm or to validate the efficacy of an intervention (for example such as probiotic treatment), this can be difficult to implement in practice.

Based on the fact that faecal microflora is representative of the GIT microflora composition (Chen et al. 2012), Lallemand has developed a protocol relying on the microbial analysis of poultry faeces to evaluate their digestive microflora status.

Two criteria can be used to evaluate faecal microflora:

- The CFU counts of common pathogens (E. coli, salmonella, enterobacteria), and total lactic microflora (lactobacilli or LAB for lactic acid bacteria), and their evolution over time.
- The ratio between the 'good' (lactobacilli) and 'bad' (enterobacteria or coliforms) bacteria: the higher, the better.

The analysis of faecal microflora is a rapid and simple indicator of both GIT microflora balance and on-farm hygiene status. Indeed, faeces represent a major pathogen reservoir in the farm, a source of cross-contamination, and a potential vector of food-borne pathogen transmission through the litter or dusts in the environment (salmonella, E. coli, clostridium).

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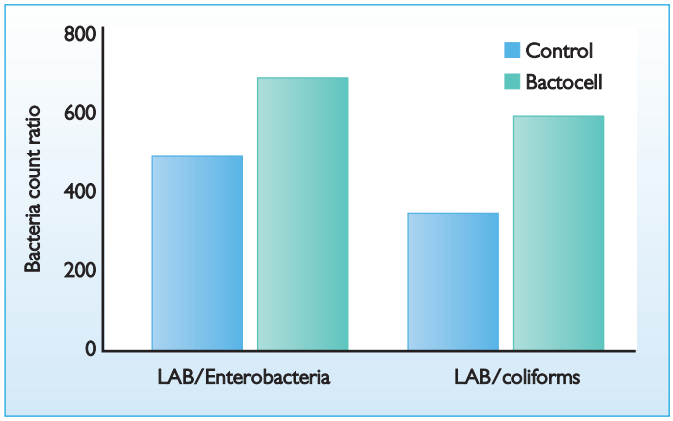

Fig. 3. Effect of Bactocell supplementation on LAB/ total coliform and LAB/total enterbacteria ratios in hens' faecal microflora.

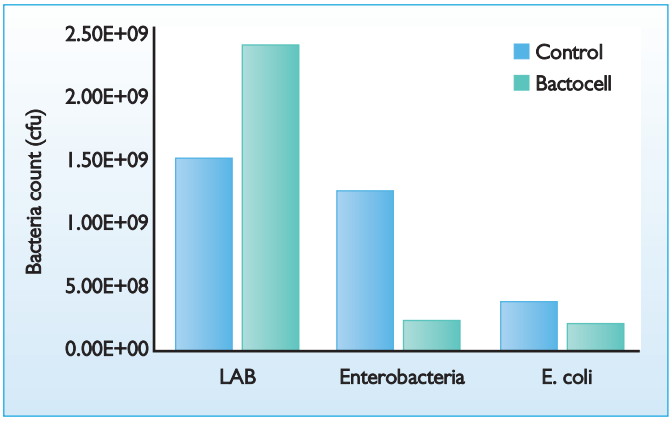

Fig. 4. Effect of Bactocell supplementation on LAB, total enterobacteria and E. coli average counts in hens' faecal microflora on commercial farms.

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In the case of probiotic interventions, it represents a short term evaluation tool as compared to the evaluation of zootechnical performance at the end of the production cycle.

Field validation

This faecal microbial analysis protocol has been validated on more than 90 samples in commercial farm settings. These analyses have confirmed the influence of Bactocell on the digestive ecosystems:

- A field trial conducted on layers in an organic layer farm in 2011 indicated a reduced count of potential pathogens (coliforms, enterobacteria and E. coli) in the faecal microflora of 50-week-old hens, as compared to an untreated control group, leading to a positive microflora balance (Fig. 3). This positive effect in the faeces was seen in parallel to an improved laying rate (+2%), confirming the link between microflora balance and bird performance.
- These results were confirmed in various commercial farm settings and conditions through a large scale field survey encompassing 39 commercial layer farms in France. Some 22 of these farms supplemented their laying hens with Bactocell, while the 17 remaining ones did not include a probiotic in their feed.

  This field survey revealed that the hens receiving Bactocell had lower E. coli counts in the faecal microflora, when compared to layers from farms not using the probiotic ($P<0.1$) (Fig. 4).

- In fattening ducks, it was also shown that supplementation with this product induced positive changes in the faecal microflora with enterobacteria, coliforms and E. coli counts decreased in the faeces after four and eight weeks of supplementation, indicating a lower pathogenic load in the digestive system of these birds.

  By helping to control the digestive microflora, Bactocell has a positive effect on the faecal microflora balance, which in turn has a positive effect on the environmental pathogens contamination (the barn, air dust), as shown in field surveys thereby creating a 'virtuous cycle'.

Conclusions

In conclusion, these data show that what the textbook says about gut microflora is actually measurable at farm level through faecal microflora analysis.

Moreover, it indicates that a positive effect on faecal pathogen loads (enterobacteria, E. coli, coliforms) and microflora balance can be expected when Bactocell is supplemented in poultry diets. There is a twofold reason for such effects:

- It reflects a positive effect on the overall digestive microflora, which is important for the birds' digestion, performance and well-being.
- A lower pathogen load in the faeces in the poultry house is a positive outcome in itself since it reduces the risk of cross-contamination and the hygiene risks for the consumer (egg contamination for example). ■