# A natural way to manage intestinal flora for a positive effect on bird health

***by Dr János Gál, Dr Bata Ltd, Hungary.***

In a study on influencing of enteric microflora, Lactobacillus acidophylicus and Bifidobacterium animals subs. lactis became the dominant beneficial intestinal flora suppressing the pathogenic bacteria (Clostridium perfringens, Pseudomonas aeruginosa, Staphylococcus aureus and Streptococcus agalactiae).

Influencing the enteral flora in a positive way also had a positive effect on the morphological characteristics of the villi, which has a significant role in digestion and absorption. The villi were 5% longer, 20% wider and the crypts were 3% deeper than in the negative control group. A positive correlation could be detected between healthy gut flora and egg production, in which the total egg number was 10% higher and egg weight 13% heavier in hens fed a diet treated with plant extracts compared to the positive control group.

| Group | Amount | Clostridium perfringens treatment |
|---|---|---|
| Negative control | - | - |
| Positive control | - | 3 times |
| Treated with plant extracts | 1kg/ton | 3 times |
| Treated with zinc bacitracin | 1kg/ton | 3 times |

***Table 1. The layout of the experiment.***

## Literature review

Several studies have focused on the intestinal flora of the broiler chicken, since production parameters are highly dependent on the intestinal digestive process. Several authors have highlighted that signs in changes and shifting of the gut flora in a negative direction include changes of feed and water intake shifting in favour of the latter and wet litter as a result.

***Table 2. Experimental layout. The Statistical Analysis System (SAS, 1999) was used for the analysis of the individual data sets.***

| Group | Infection | Additional treatment |
|---|---|---|
| Negative control | - | - |
| Positive control | $10^6$ cfu/ml Clostridium perfringens | - |
| Treated with plant extracts | $10^6$ cfu/ml Clostridium perfringens | Mixed of plant extract 1kg/ton |

Ireland et al (1984) presents the connection between intestinal flora development and the age of the chickens. His findings show that one day old chicks have sterile intestines, with no bacteria. Streptococcus and coliform bacteria can be found in three day old animals. Lactobacillus appears later which stabilises after 40 days of age.

Barnes et al. (2007) also found Lactobacillus to be the dominant bacteria in the intestines. The authors also mention E. coli, Streptococcus sp., Bacterioides sp. and Lactobacillus sp. in chicks older than 40 days.

Proietti et al. (2008) compared gut flora of animals kept in the so called conventional and bio way, and found that enterobacteria, Enterococcus and Lactobacillus ratio was higher in conventionally kept chickens.

Another research team focused on the connection of intestinal flora and how the

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| | Length of villi | Width of villi measured in the middle | Depth of the crypts |
|---|---|---|---|
| Negative control | 2.21 | 0.196 | 0.33 |
| Positive control | 2.09 | 0.184 | 0.273 |
| Treated with plant extracts | 2.30 | 0.234 | 0.323 |
| Treated with zinc bacitracin | 2.20 | 0.189 | 0.285 |

***Table 3. The development of the parameters of the villi in the different experimental settings.***

animals are kept and examined free range and stalled chickens. Lactobacillus sp. and E. coli was found in both cases. They also found Proteus vulgaris, Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecium, Bacillus megaterium and Streptococcus pyogenes in the intestines of free range chickens.

Jin et al. (1997) did research on the intestinal components of chickens kept in tropical conditions. They found Lactobacillus sp., Streptococcus sp. and E. coli in the small intestines and Streptococcus sp., Staphylococcus sp., Lactobacillus sp., E. coli, Eubacterium sp., Propionibacterium sp., Clostridium sp., Fusobacterium sp. and Bacterioides sp. in the caecum. Most publications find Clostridium perfringens to be the root of necrotic enteritis in chicken. The strains producing $\alpha$- and $\beta$-toxins have the greatest importance in the formation of disease if anaerobic conditions develop in the intestines due to poor feeding and if any kind of mucosa harming predisposing factor occurs.

The normal bacterial gut flora changes with intestinal epithelium damage in the lumen, with the disruption of the absorbing and digestive processes close to the enterocytes which can be caused by several viral infections. The gut flora and the normal microbial environment of chickens gets damaged in case of the runting stunting syndrome. Yang et al. (2009) reported the positive effects of some plant agents as an additive in the feed. Polysaccharides stimulate the immune system, which has a role in the prevention of the overgrowth of some Clostridium sp. species.

## Materials and methods

The author examined the additional effect of a complex diet containing plant extracts on the reproduction of some gut bacteria, on the villi and through this the effect on some parameters in production.

50 Cobb broiler chickens were used per group in the research, which were fed ad libitum with a 1kg/ton mixed complex premix diet including plant extracts.

A bacterial swab was taken from the cloaca on the 10th day, which was cultured under aerobic and anaerobic circumstances, which then got examined for bacterial growth.

Some 115 broiler chickens/group were used in the second part of the research in four groups and 2ml $10^8$ cfu/ml Clostridium perfringens bacterial suspension was given to the chickens through a crop tube on day 18, 21 and 24 of the experiment. The layout of the experiment is shown in Table 1.

The animals were euthanised at the end of the experiment and a piece of the small intestines was fixed in 8% buffered formaldehyde solution. The fixed pieces of the intestine were embedded in paraffin, then cut and stained with haematoxilin-eosin and examined for the length and the thickness of the villi and the deepness of the crypts.

We were also looking to answer how the egg production was influenced by the Clostridium perfringens infection in hen groups treated with plant extracts and the control group. To examine this, 32 week old hens were used in the experiment as

| | Total egg production (pcs) | Total egg weight (g) | Change in average egg weight collected (g) | Feathers |
|---|---|---|---|---|
| | 10 week period | | | |
| Negative control group | 633 | 42,329 | 66.86 | Moderately ruffled |
| Positive control group | 608 | 40,123 | 65.99 | Heavily ruffled, deficient |
| Treated with plant extracts | 667 | 45,451 | 68.14 | Tight, ordered, intact |

***Table 4. Egg production values with the different experimental settings.***

seen in Table 2. The hens were placed in a standard cage with ad libitum feed and water and 12 hours of lighting. Eggs were collected twice daily and the total egg production (pcs), the total egg weight and the average egg weight were evaluated with the weighing of every individual egg over a 10 week period.

The hens taking part in the experiment were under clinical supervision over the whole period of the experiment.

## Results and discussion

Our first examination showed that Lactococcus lactis, Lactobacillus acidophylicus, Bifidobacterium animals subs. lactis were cultured from cloacal swabs when fed a diet with plant extracts in 1kg/ton concentration, which partially matches the findings of Barnes et al. (2007), while Clostridium perfringens, Pseudomonas aeruginosa, Staphylococcus aureus or Streptococcus agalactiae could not be isolated. We believe that similar to the findings of Yang et al. (2009), plant extracts have a positive effect on the intestinal flora. However facultative and obligate pathogenic bacteria do not have a role in the intestinal tract of birds, as mentioned by Saliu et al. (2012).

Our findings on the development of the villi can be seen in Table 3.

Our measured values show that the length of the villi is 5% and the width is 20% bigger and the depth of the crypt is 3% deeper than in the negative control group.

This means that chickens fed a diet with additional plant extracts have a bigger surface on the villi of the small intestines, which also defines the microbiological environment. Table 4 summarises the results of the connection between egg production, Clostridium perfringens infection and gut flora.

The worst parameters were produced by the Clostridium perfringens infected untreated group regarding all parameters (total egg production, total body weight and average egg weight).

We found a significant difference in the production parameters in this group in comparison with the infected group that fed on a diet with plant extracts. The total egg number was 10%, the total egg weight was 13% higher in the group fed a diet with plant extracts compared to the positive control group. Egg weight was 2g better in this group. Examining the bird's feathers we found that the feathers of the positive control group were the most ruffled, while the group treated with plant extracts was the most intact.

We found intestinal flora has a great effect on the health of the hens and egg production with this data as well.

We highlight that, corresponding with the results of Yang et al. (2009), feed with plant extracts has a positive effect on the digestion and health of birds. ■

*References are available from the author on request*