

# Producing chicken without antibiotics: an integrated and multi-factor approach

Antibiotic resistance will cause 10 million deaths per year by 2050! However, the non-use of antibiotics is quite challenging as it is often associated with reduced growth and feed efficiency, several subclinical infections, an increase in necrotic enteritis, litter degradation and modification of microflora (see Table 1).

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These consequences are due to an increased competition for nutrients between the microbiota and the animal, a production of specific metabolites depressing growth via microflora and reduced nutrient absorption through the intestinal wall.

Therefore, to totally suppress antibiotics in poultry farms a full program combining prevention and biosafety measures needs to be implemented.

Prevention implies reducing mainly vertical pathogen transmission. To achieve this goal, several methods can be considered: vaccination and auto-vaccination (*E. coli*, coccidiosis, etc), hygiene of buildings and equipment, ventilation, homeopathy, aromatherapy, water quality and, of course, adjusting animal feed.

Indeed, this is crucial to control the diet

	Without (n=51)	With (n=51)	P value
Survival (%)	98.4	98.6	0.49
Slaughter age (days)	38.5	38.1	0.17
Weight at slaughter (kg)	2.38	2.43	<0.01
ADG (g/d)	61.5	63.5	<0.001
Feed conversion (g/g)	1.84	1.78	<0.01
Clinical necrotic enteritis (% batch)	27.45	0	<0.001
Subclinical enteritis (% batch)	49.02	0	<0.001

**Table 1. Impact of an antibiotic-free diet on poultry performance (Gaucher 2015, *Poult Sci.* 2015 Aug;94(8):1791-801).**

and fine-tune nutrient levels for energy and proteins, so as not to lose too much performance while reducing risk.

For example, in the small intestine, populations of enterococci and coliforms are significantly decreased with fibrous diets (see Figs. 1 and 2).

In the caeca, we can also observe an increase of bifidobacteria and a decrease of the enterococci with fibre-rich diets, mainly with the SBP (beet pulp) diet.

These results show that the quality of the fibres in feed influences the profile of the microflora in the digestive tract, with positive effects: a decrease of potential

pathogen bacteria like enterococci and coliforms and an increase of beneficial bacteria like bifidobacteria.

In addition, it means using selections of flora and inflammation management ingredients, which have been proven to offer health benefits.

## Plant extract benefits

The CCPA Group tested the effects of a combination of plant extracts: *Curcuma longa* and *Scutellaria baicalensis*, against caecal inflammation induced by *Salmonella enteritidis* (*S. enteritidis*) infection in chickens. These effects were compared with oxytetracycline supplementation (OTC).

Some 72 newly hatched ISA Brown males of the egg laying chicken line were divided into three groups.

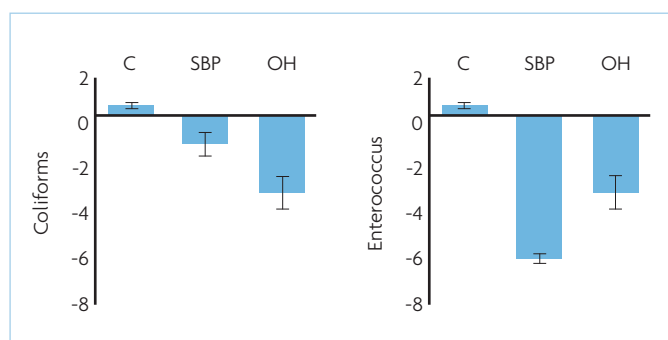
For the trial duration, the first group received a control diet, the second group received the control diet supplemented with oxytetracycline, and the third group received the control feed supplemented with liposoluble phenolic acid extract from *Curcuma* and hydrosoluble extract from *Scutellaria*.

On the seventh day, half of the chickens within each group were infected with *S. enteritidis*. On the fourth day and on the 14th day post-infection, six chickens from each group were sacrificed (see Fig. 3).

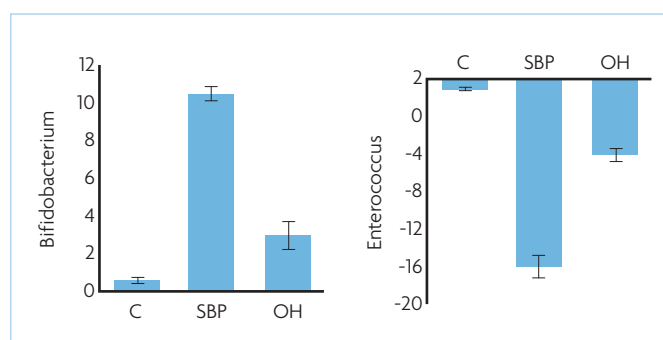
Samples from the spleen, liver and caecum were collected to enumerate *S. enteritidis*.

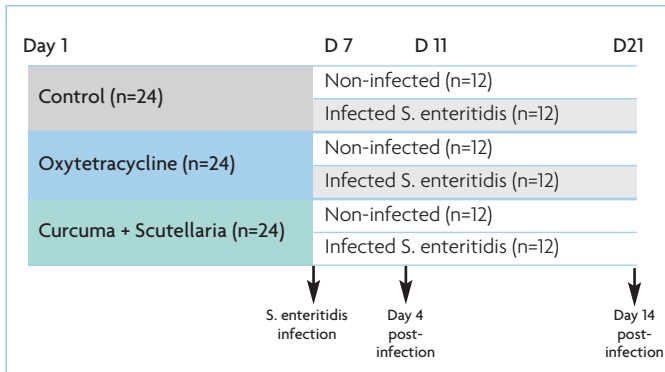
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**Fig. 1. Evaluation of fibre-rich diets (SBP = beet pulp, OH = oat husks) on coliform and enterococci populations in the small intestine (Bébin et al., 2017).**



**Fig. 2. Evaluation of fibre-rich diets (SBP = beet pulp, OH = oat husks) on bifidobacteria and enterococci populations in the caeca (Bébin et al., 2017).**





**Fig. 3. Trial protocol.**

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Expression of cytokines and acute phase genes was studied in the caecum.

Our results show that the association of curcuma and scutellaria extracts decreased, at gene expression level, gut inflammation induced by *S. enteritidis* ( $P < 0.05$ ). This decrease was almost to the extent of the antibiotic.

Salmonella counts on the fourth day and 14th day post-infection showed a decrease in caecum, liver and spleen with the plant extract supplementation (significant at day 14 post-infection).

Supplementation with the antibiotic eradicated salmonella in the caecum, while significantly decreasing it in the spleen and liver at both days post infection.

The supplementation of chicken feed with

extracts from curcuma and scutellaria thus decreased inflammation in the chicken caecum induced by *S. enteritidis* infection, and also reduced *S. enteritidis* translocation in the liver and spleen (see Fig. 4).

The use of this plant association – integrated in the poultry additive premix Axion Feed Stim – is promising for poultry production to maintain intestinal health by using alternative non-antibiotic products.

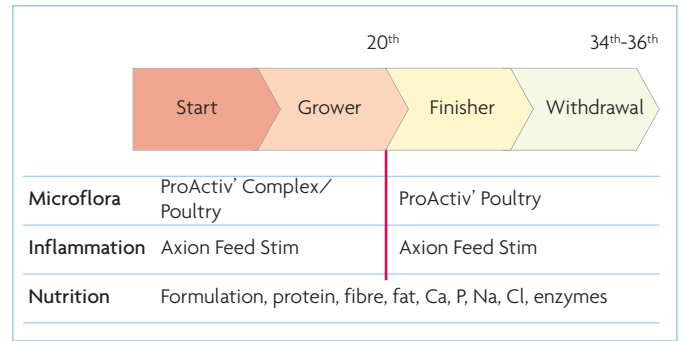
The CCPA Group has thus implemented a specific nutritional programme which combines selected probiotics, prebiotics and organic acids as well as formulation expertise (support, raw materials knowledge, enzyme screening).

For this approach, several feed additive premixes (ProActiv' Poultry and Axion Feed Stim) include specific plant extracts and

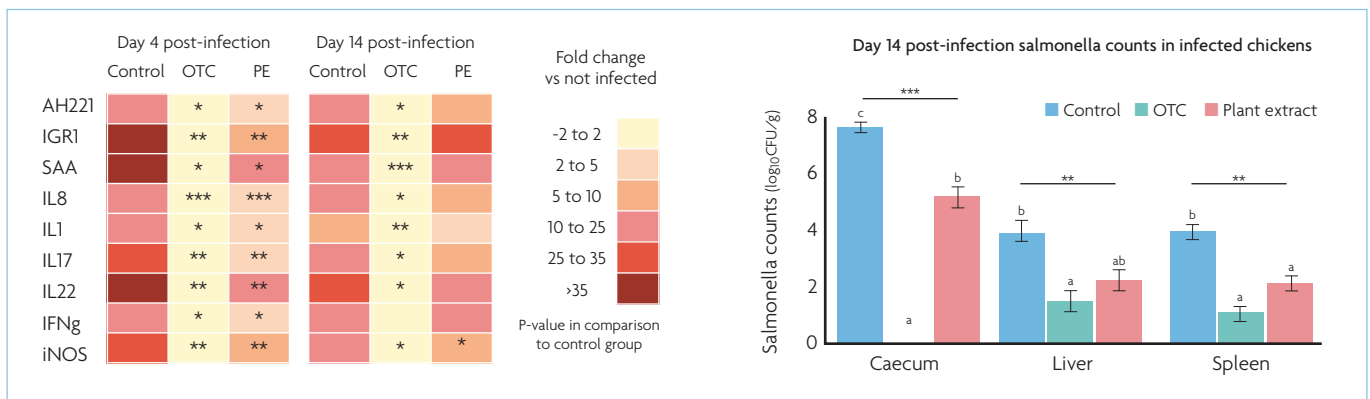
spices for successful microflora management and inflammation control (see Fig. 5), throughout the poultry life cycle. This programme is of course to be adapted according to the context and production area.

The CCPA Group set up conclusive field results of demedication in different contexts, in European countries and outside Europe.

In a field trial conducted in 2018 in an experimental station in Latin America with Ross 308 chickens, the CCPA Group's specific nutritional approach – with the use of the additive premix ProActiv' Poultry – achieved an effective alternative to antibiotic growth promoters, with superior results: +4% live weight/chicken, +1.1% feed conversion rate, and -0.84% mortality (see Fig. 6). ■



**Fig. 5. The CCPA Group's Poultry nutritional program adapted to demedication strategies.**



**Fig. 4. Plant extracts allowed a reduction in gut inflammation gene expression and *S. enteritidis* count in organs (Trial results, CCPA Group, 2018).**

**Fig. 6. Comparison of results for performance and animal health (Trial results, CCPA Group, 2018).**

