A global feed expertise is required to manage poultry intestinal health

Antibiotics are efficient solutions to manage poultry intestinal health. However, the use of antibiotics can generate antibiotic resistance which compromises their effectiveness in livestock when used for health issues. They can also select non-pathogenic bacteria via possible transfer of resistance to pathogenic bacteria (and vice versa).

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The acquisition of resistance to one antibiotic can cause resistance to one or more other antibiotics (cross-resistance) and increase the risk of multi-resistant bacteria.

The emergence of antibiotic resistance is an issue taken seriously by consumers, governments, and poultry producers. New production practices and alternative feed solutions are emerging to preserve human and animal health.

A major economic challenge

However, antibiotic-free production can be associated with many challenges – a decrease in performance (live weight, FCR, viability), an increase in subclinical infections like enteritis (necrotic), contaminated litter, and more foot pad dermatitis. At gut level, there is more potential development of pathogenic bacteria that alters the gut mucosa, less absorption of nutrients via the intestinal wall and more production of metabolites depressing growth via microbiota. This is a major economic challenge.

A recent Brazilian study calculated that the cost of decreased feed digestion (higher FCR) could be 222 million dollars per year (based on the production of 5.8 billion chickens per year).

To succeed in this type of production, production practices need to ensure a complete digestive security.

Demedication expertise

The CCPA Group has built its expertise on demedication for many years. Working on feed security is the way to promote gut health thanks to a global approach including improved feed digestibility (supply less nutrients for bacteria development), adequate fibre level, protein level, particle size distribution, optimised enzyme use, maintain the integrity of the gut cells (to promote good nutrients absorption and prevent inflammation).

Protein and its quality must be given special attention as too high a level of undigestible protein can decrease global digestibility and leg health (Table 1). The evaluation of feed ingredients and their digestibility must be managed properly in the feed matrix.

The right feed formulation is not sufficient to ensure gut health in challenged conditions. Essential oils like thymol and carvacrol can improve the health of the gut mucosa. At ileum level, deeper crypts, and faster cellular turnover with better renewal of the villus were measured. Gene expression in the ileum was modified: occluding gene expression was up-regulated and TLR2 gene expression was down-regulated.

Proinflammatory cytokine TNF- alleviate inflammation was decreased. Consequently, nutrients were better absorbed, intestinal macroscopic lesions were reduced with less inflammation and less disruption of the tight junctions at the epithelial cells of the ileum mucosa.

Essential oils might also be able to directly modulate the flora population. Bacteria can secrete and detect external signalling molecules. They use quorum sensing to regulate certain phenotype expressions, like biofilm formation, gut adhesion and virulence factors (toxins, protease).

The quorum-sensing function is based on the local density of the bacterial population in the environment.

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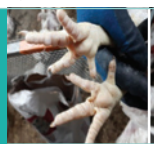
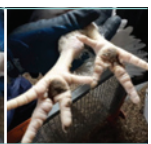
Fig. 1. Foot pad dermatitis was strongly improved in a field trial done in Europe in 2020.

Table 1. Influence of undigestible protein content in the feed on chicken performance, litter quality and leg health (CCPA Research Center 2019). On the same line, different letters means significant difference ($p<0.05$) and the same letter means no significant difference ($p>0.05$).

Undigestible protein in the feed	Low	Medium	High
ADG (g/day)	66.6[a]	64.8[b]	61.8[a]
FCR (0-42 days)	1.57[a]	1.57[a]	1.64[b]
Ratio water/feed intake	2.3	2.5	2.8
Foot pad dermatitis score (from 0 low level to 5 high incidence) at 41 days	1.6[a]	3.0[b]	4.2[c]
Dry matter of the litter at 29 days	57.8[a]	53.0[ab]	48.4[b]

Table 2. Reduction of foot pad dermatitis in chickens of 31 days in field conditions (CCPA trial, 2019).

Foot pad dermatitis score at 31 days	 Score 0	 Score 1	 Score 2
Variation number chickens with Proactiv' Poultry BX (%)	+5%	+10.5%	-15.5%

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Both Gram-positive and Gram-negative bacteria use quorum sensing.

Carvacrol was shown to inhibit quorum sensing of some bacteria, suppressing the communication between them. It was measured that the motility and development of bacteria was depressed.

Quorum sensing has been known for more than 20 years but research on the effects of plant secondary metabolites like carvacrol is quite new.

Deficiencies in the butyrate production by the microbiota can increase inflammation in the intestinal tract. In chickens, supplementation with butyrate improved digestibility and absorption of dietary nutrients by protecting the intestinal epithelial barrier integrity and modulating effects on gut microbiota like reduction of salmonella colonisation.

Tailor-made natural solution

The CCPA Group has developed ProActiv' Poultry, a tailor-made natural solution to manage the digestive security of poultry. This product relies on the power of a combination of plant extracts.

The CCPA Group has been running trials for many years in various countries.

Table 3 lists some of the research works that have been run to contribute to better intestinal status. In the last few years, more attention has been given to control the litter and the dermatitis quality.

Recently, ProActiv' Poultry BX (including sodium butyrate) has demonstrated its effectiveness in foot pad quality. At commercial production level, litter and dermatitis quality are the key measurements for evaluating the gut health status.

Since the broiler EU regulation 2007/43/EC was published, the occurrence of contact dermatitis must be monitored as part of the welfare protection for broiler chickens.

Contact dermatitis results from contact of the feed with wet litter, resulting in foot pad dermatitis, hock burn or breast blisters. CCPA use a scale of three or five categories from small, superficial, serious, deep subcutaneous and inflamed ulceration (Itavi). Using Proactiv' Poultry BX in the feed, the foot pad dermatitis was significantly ($p<0.05$) decreased.

The percentage of chickens with the most damaged pads was decreased by 15.5%. The dry matter in the litter increased by 2% (49% vs 51.1%, Table 2).

In conclusion, a good impact on performance was related to a better intestinal status thanks to the combination of essentials oils, plant extracts and butyrate.

In trials with hens, drier faeces and better intestinal health could help to obtain better performance, as with chickens. ■

References are available from the author on request

Table 3. List of research works performed in the demedication project.

Country (year)	Poultry genetics (duration)	Compared to	Condition	Difference in performance with ProActiv'	Number of birds
South Africa (2015)	Ross chickens (1-35 days)	Phyto product	Field	FCR -0.03, live weight +60g	360,000
France (2015)	Hubbard GP hens (26-40 weeks)	No supplement	Field	Lay +1.8pt, hatch rate +1.7pt, chick weight at seven days +3.6%	240
Latin America (2018)	Cobb and Ross chickens (1-39 days)	Virginiamycin	Field	Live weight +103g, mortality -0.8	8,500,000
North Africa (2016)	Cobb and Ross chickens (1-35 days)	Probiotic	Field	FCR -0.06, mortality -0.7, live weight +40g	37,000,000
Czech Republic (2019)	Cobb breeders hens (33-50 weeks)	Phyto product	Field	Lay 40 weeks +2.6pt, lay 50 weeks +5.5pt, day old chick at 50 weeks +0.9	29,630
Asia (2019)	Hubbard and Arbor Acre chickens (1-35 days)	Avilamycin and virginiamycin	Research centre	FCR -0.07 and -0.03, mortality -2.6 and -1.3	2,000
Europe (2019)	Ross chickens (1-39 days)	Nosiheptide	Field	FCR -0.03	151,500
Europe (2020)	Ross chickens (1-40 days)	Virginiamycin	Field	Foot pad dermatitis -47pt and -24pt	1,605,000
Europe (2021)	Ross chickens (1-39 days)	Standard feed	Field	ADG +1.6g/d, mortality -2.9pt, foot pad dermatitis -12.3pt	12,300,000