Is combining additives the answer to antibiotic-free production?

One of the most effective tools to maintain gastrointestinal health of poultry is antibiotics. But in recent years, pressure from consumers and government regulations have driven poultry producers toward limited, antibiotic-free or no antibiotics ever at a rapid pace globally.

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While this is a challenge for all of animal agriculture, poultry producers can experience a significant impact due to the short duration from hatching to processing. After all, challenged birds do not perform as well and producers do not have much time to cure a flock before the problem impacts the bottom line.

In the absence of in-feed antibiotics, producers are turning to nutritional intervention as part of a multi-pronged strategy for maintaining a healthy gut and preventing enteric diseases.

Several categories of feed additives including enzymes, probiotics, prebiotics, organic acids, essential oils, and immune stimulants have been evaluated for their potential as antibiotic alternatives with a varied degree of success.

But, given the complexity of gut health challenges, it is unlikely a single ingredient feed additive will emerge as the ultimate alternative to all antibiotics.

For the poultry industry to go antibiotic-free, understanding the source of a gut health challenge and how certain feed additives under certain conditions can help to mitigate the challenge in the first place or impact the severity/duration of a challenge is critical. It is through this knowledge that producers will decide when and which additives to use to maintain gut health and therefore the productivity of a flock.

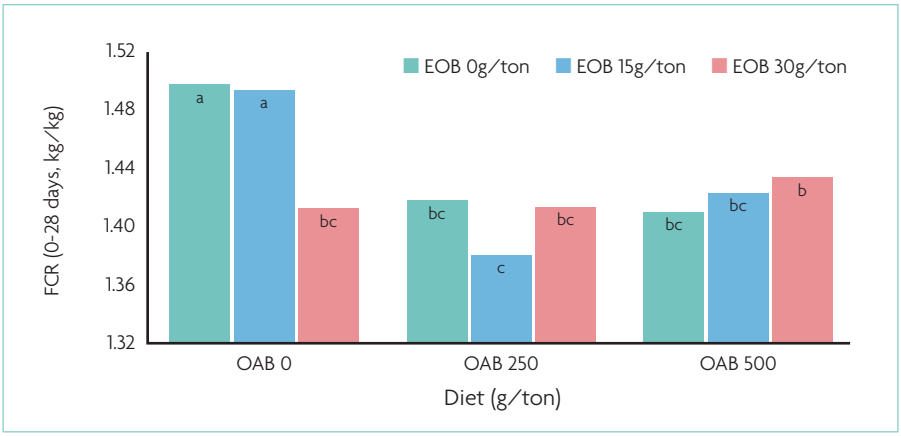

Fig. 1. Feed conversion ratio on day 28 as affected by treatments.

Combining additives

Both essential oils and organic acids have been demonstrated to improve growth performance and gut health in broiler chickens. Essential oils have been shown to have antioxidant properties, modulate host immunity, enhance digestion, as well as reduce the levels of pathogenic bacteria.

Organic acids are known for their antimicrobial properties under acidic conditions and they have been shown to reduce pathogenic bacteria load and increase digestion.

With their different mechanism of action, Novus International Inc wanted to see if combining these two types of feed additive could provide additional benefits. From the product portfolio, researchers chose essential oil blend Next Enhance 150, a 1:1 combination of thymol and carvacrol (EOB) that is noted for reducing inflammation, modulating immunity and its antioxidant properties. The organic acid blend Avimatrix chosen in this study is a protected blend of benzoic acid, calcium formate and fumaric acid (OAB) that has been shown to have an antimicrobial effect, particularly against E. coli and Clostridium perfringens.

Floor pen study

A floor pen study with 1,728 day-old male broilers was conducted at a Novus research farm in the United States to evaluate EOB and OAB, alone or in combination, on growth performance and gut health of broilers subject to mild Eimeria challenge.

The study consisted of nine dietary treatments in a 3 x 3 factorial arrangement with three levels of EOB (0, 15, and 30g/ton) and three levels of OAB (0, 250, and 500g/ton). Each diet was fed to eight replicate pens of 24 birds. All birds were orally gavaged with a coccidiosis vaccine at five times the recommended dose on day 14.

Body weight, feed intake, feed conversion ratio, and mortality were determined on days 21, 28, 35, and 41. On day 22, jejunal tissues were collected for cytokine mRNA

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Table 1. Feed conversion ratio (FCR) as affected by treatments.

Effect	Day 21	Day 28	Day 35	Day 42
EOB	0.74	0.24	0.27	0.56
OAB	0.57	<0.0001	0.001	0.07
EOB*OAB	0.04	0.001	0.00	0.11
CV (%)	1.50	3.07	2.36	2.83

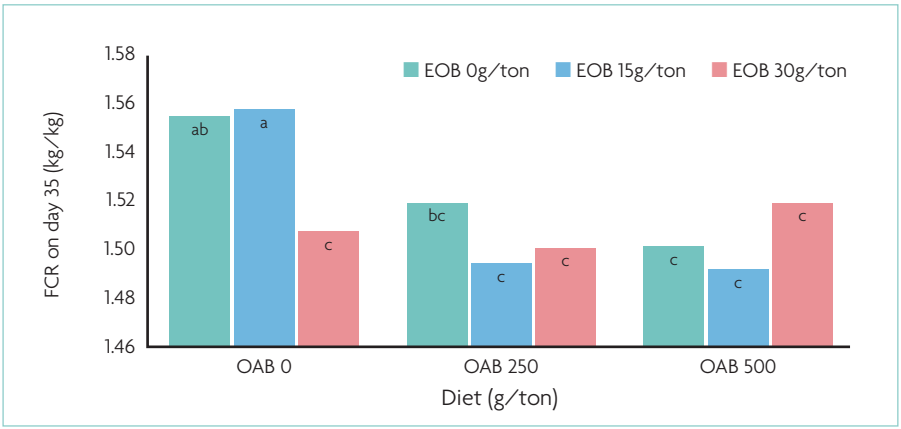

Fig. 2. Feed conversion ratio on day 35 as affected by treatments.

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expression. On day 42, footpad dermatitis lesions were scored (Fig. 3). Data was subject to 2-way ANOVA to evaluate the main effects and their interaction; means were separated by Fisher's protected LSD test.

In the challenged birds, the results showed that while body weight was not affected over the course of the trial, feed conversion ratio was sensitive to the dietary treatments.

The best response was observed on days 28 and 35. There was a significant interaction between EOB and OAB ($P<0.05$) where, except for EOB at 15g/ton, all treatments significantly improved feed conversion ratio on those days.

The best feed conversion ratio was observed with combining 15g/ton EOB and 250g/ton OAB. A significant interaction was also seen for footpad dermatitis where combining EOB (15g/ton or 30g/ton) with OAB (500g/ton) reduced footpad dermatitis lesion scores and increased percentage of healthy footpad scores ($P<0.05$).

Finally, researchers found evidence of immune modulating function for the essential oil blend at 30g/ton which significantly reduced jejunal IL-10 mRNA expression ($P<0.05$) (data not shown).

Table 2. Footpad dermatitis and litter score as affected by treatments.

Effect	FPD lesion	FPD (%) 1+2	Litter score
EOB	0.062	0.005	0.400
OAB	0.002	0.002	0.876
EOB*OAB	0.108	0.105	0.383

Conclusion

In summary, the organic acid blend improved feed conversion ratio, while the essential oil blend improved feed conversion ratio and modulated immune response. Together these two specific products resulted in better feed conversion ratio and lower incidence of footpad dermatitis.

This strongly indicates that additional benefits could be achieved with these two additives working in combination.

Further research will be aimed at confirming the benefits of these specific combinations over individual products and testing the combinations under different dietary and pathogenic challenging conditions. ■

Fig. 3. Footpad dermatitis as affected by treatments.