



Phytogenics: combinations and synergies in poultry feed

Broad utilization of phytogenics in animal feed results in different modes of action

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Phytogenic feed additives represent an important class of natural feed additives used as natural enhancers of livestock performance and feed utilization.

Phytogenics consist of plant-derived, bioactive substances, including the whole repertoire of secondary plant metabolites. They comprise a multitude of different substance classes, which offer a broad spectrum of modes of action.

Essential oils, saponins, flavonoids, mucilages, tannins, pungent substances, bitter substances — each influences an animal's physiology with specific modes of action, for example, regulating the

secretion of digestive juices and influencing intestinal nutrient transporters, antioxidant and anti-inflammatory effects, quorum sensing inhibition and gut wall protection.

Continuing phytogenic research

While initially met with skepticism, phytogenic feed additives are increasingly accepted in animal nutrition and production. Ongoing fundamental and applied research to uncover the diverse modes of action of phytogenics has been explored through standardized trials and independent evaluations. Such studies have also identified why and how phytogenic feed additives achieve the broad spectrum of claimed benefits.

Phytogenic feed additives represent a wide range of classes of plant-derived

substances, each with individual modes of action. However, the research becomes even more complex when trying to understand how specific mixtures of phytogenics influence an animal's physiology in their interaction.

Although further research on this topic is required, there is good evidence that the combination of different phytogenic substances may pronounce the effects of the single components.

Effect on broiler digestibility

A 21-day study of 144 Cobb 500 broiler chickens aimed to investigate the effect of a specific essential oil blend and a saponin mixture on apparent ileal nutrient and amino acid digestibility. Researchers randomly fed the birds four treatments and either supplemented a) no additive, b) an essential oil blend



The potential of phytogenic feed additives: <https://bit.ly/2RpHG5I>

from star anise, rosemary, thyme and oregano, c) a quillaja saponin mixture or d) a combination of the essential oil blend and the saponin mixture to the standard diet.

At the end of the trial, ileal digesta were analyzed using standard laboratory methods and the dry matter, crude protein, crude fat, crude ash, calcium and phosphorus were determined. Amino acids in the diets and the ileal digesta were measured by ion exchange chromatography.

The apparent ileal digestibility of lysine as the first limiting amino acid in most broiler diets was significantly increased with the supplementation of essential oils or the combination of both phyto-genic additives to the feed and numerically increased in the saponin group compared to controls. Moreover, there was a numerical increase of lysine digestibility in birds fed on a diet supplemented with both phyto-genic additives in comparison to birds fed on a diet with only one out of the two phyto-genic additives.

Comparable results were found for numerous other amino acids like alanin, aspartic acid, glutamic acid, glycin, leucin phenylalanine and serin.

To unroll the mode of action responsible for these results on apparent ileal digestibility, the authors conducted *in vitro* analysis with Caco-2 cell culture investigating specific transporters (sodium-glucose transporter 1 [SGLT1] and peptide transporter 1 [PEPT1]) involved in jejunal

glucose and amino acid uptake.

With total internal fluorescence microscopy (TIRF), it could be demonstrated that the essential oil blend and the saponin mixture promote the recruitment of SGLT1 and PEPT1 to the cytoplasmic

membrane, which is necessary for the absorption of glucose, small peptides and amino acids.

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PHYTOGENICS

decades, phytogetic feed additives turned out to be a potent tool to modify the physiology of livestock animals allowing to boost their performance.

PhytoGENICS comprise a broad spectrum of plant-derived substance

classes, not restricted to essential oils only — this diversity makes research more complex, but it represents a huge potential for future development of innovative phytogetic feed additives. Systematic studies on nutrient

digestibility prove that supplementing a combination of essential oils with saponins exceeds the beneficial effect of those phytogetic compounds in comparison to feeding the same compounds separately. ■

Effects of dietary supplementation of essential oils, saponins and combinations on digestibility in 21-day-old broilers

Treatment group	Control	Essential oils	Saponins	Essential oils + saponins	P value
Dry matter (%)	52.5 ± 2.2	51.8 ± 4.7	50.0 ± 3.3	52.8 ± 5.5	0.390
AID of nutrients (%) crude ash	42.3 ± 4.1 ^a	44.6 ± 2.7 ^{ab}	45.6 ± 0.9 ^{ab}	46.7 ± 3.7 ^b	0.034
crude protein	80.8 ± 2.3 ^a	83.1 ± 1.2 ^b	83.2 ± 1.4 ^b	84.0 ± 1.5 ^b	0.002
crude fat	97.7 ± 0.2	97.5 ± 1.1	97.3 ± 0.6	97.7 ± 1.3	0.761
calcium	42.5 ± 4.7	45.1 ± 2.5	45.2 ± 3.6	44.7 ± 2.1	0.310
phosphorus	51.3 ± 5.3	53.6 ± 3.5	53.2 ± 4.2	53.0 ± 3.4	0.657
AID of amino acids (%) alanine	79.0 ± 2.5 ^a	80.9 ± 2.1 ^{ab}	81.8 ± 2.0 ^{ab}	83.1 ± 2.6 ^b	0.006
arginine	88.3 ± 1.5 ^a	90.8 ± 3.2 ^b	89.0 ± 1.4 ^{ab}	90.8 ± 1.0 ^{ab}	0.022
aspartic acid	78.6 ± 2.5 ^a	81.0 ± 1.4 ^{ab}	80.4 ± 2.0 ^{ab}	81.9 ± 1.8 ^b	0.008
cysteine	71.6 ± 2.9	73.0 ± 2.4	70.5 ± 5.5	72.0 ± 4.3	0.626
glutamic acid	82.6 ± 2.2 ^a	84.0 ± 1.0 ^{ab}	83.9 ± 1.7 ^{ab}	85.7 ± 1.6 ^b	0.004
glycine	76.1 ± 2.6 ^a	78.4 ± 1.4 ^{ab}	78.2 ± 1.9 ^{ab}	80.1 ± 2.1 ^b	0.003
histidine	85.3 ± 1.6	85.7 ± 1.8	84.6 ± 2.0	86.1 ± 1.7	0.338
isoleucine	80.1 ± 2.4 ^a	83.7 ± 1.3 ^{bc}	81.9 ± 2.8 ^{ab}	85.6 ± 2.3 ^c	<0.001
leucine	82.6 ± 2.0 ^a	84.9 ± 1.0 ^b	84.7 ± 1.8 ^{ab}	86.0 ± 1.9 ^b	0.002
lysine	83.8 ± 1.9 ^a	86.8 ± 1.0 ^b	85.6 ± 1.6 ^{ab}	87.2 ± 1.8 ^b	<0.001
phenylalanine	85.3 ± 1.8 ^a	87.1 ± 0.9 ^{ab}	86.8 ± 1.6 ^{ab}	88.1 ± 1.7 ^b	0.005
proline	84.2 ± 2.0	84.8 ± 1.2	85.0 ± 1.6	85.5 ± 1.6	0.383
serine	80.6 ± 2.5 ^a	82.6 ± 1.2 ^{ab}	82.9 ± 1.7 ^b	83.7 ± 1.6 ^b	0.008
threonine	74.7 ± 3.3 ^a	78.0 ± 1.6 ^b	77.1 ± 2.2 ^{ab}	78.5 ± 2.5 ^b	0.012
tyrosine	77.2 ± 4.0 ^a	80.9 ± 1.6 ^b	79.6 ± 2.1 ^{ab}	80.3 ± 2.1 ^{ab}	0.030
valine	76.7 ± 2.6 ^a	80.9 ± 2.1 ^b	79.4 ± 2.8 ^{ab}	83.1 ± 2.6 ^c	<0.001

^aValues with different letters within lines differ significantly ($P < 0.05$).

Source: Reyer et al. 2017

This table demonstrates the effects of dietary supplementation of essential oils, saponins and combinations on apparent ileal digestibility in 21-day-old broilers.

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