

A feed additive containing bioactive lignans derived from wood can support broilers to combat inflammation, potentially reducing the use of antibiotic growth promoters.



Managing gut health and wet litter with dietary wood lignans

The saying, gut health is the best performance enhancer, is widely accepted today. Particularly true when broilers are produced using feeding programs with no antibiotic growth promoters (AGPs). Birds are exposed to various stressors throughout the production period. It is not only pathogens, toxins, infections, or environmental stressors that represent threats to animal health and performance. Also, the presence of several components in commercial feed, such as non-starch polysaccharides, excess protein, antinutritional factors, oxidized lipids or allergens often causes low-grade, persistent inflammation and oxidative challenge in intestine.

The digestive system is vulnerable and can easily be disturbed by such stressors. In fact the small intestinal mucosa, which represents the bird's absorptive surface, is still comparable in its dimensions with the original conditions of the old broiler breeds of 100 years ago when extensive, near-natural husbandry conditions still prevailed and the growing period was significantly longer. The mucosa reacts to the various stressors with inflammation. However, inflammatory processes are energy-consuming



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NINA NEUFELD and TOBIAS STEINER* conclude that a wood lignan-enriched feed supplement is a valuable tool to support intestinal health in broilers, by exerting antioxidant, anti-inflammatory and barrier-strengthening effects.

Table 1: Effects of LPS challenge with and without wood lignans in a THP1 cell test system.

	IL-6	IL-1β	IL-8	TNF
Control vs. LPS	Significant	Significant	Significant	Significant
Control vs. lignans			Significant	
LPS vs. LPS + lignans	Significant	Significant	Significant	Significant

Significant = $p < 0.05$.

and reduce the bird's performance, even if no clinical signs of enteritis, diarrhea or mortality are visible.

Wet litter is a clear sign of suboptimal conditions in the intestinal tract. One must assume gut inflammation, which is accompanied by limited absorption, secretion of body fluids into the intestine, and increased water intake.

For the bird, this means loss of energy and protein for the working of the immune system, decreased uptake of nutrients from the intestinal lumen, loss of fluid and protein via the intestine, and increased energy consumption for all metabolic processes associated with water intake and excretion.

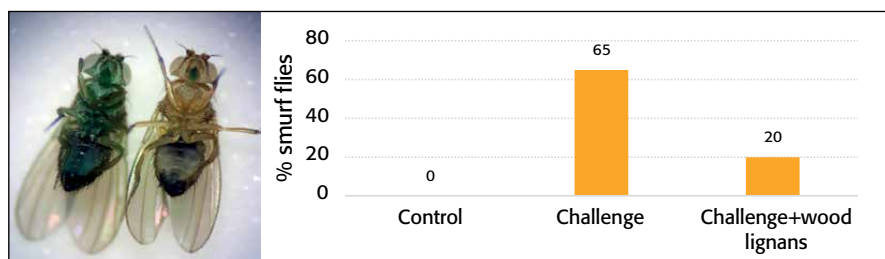
The result is poor litter quality which leads to further health problems such as foot pad dermatitis.

The efficacy of many traditional AGPs has slowly deteriorated over the decades due to resistance. The use of natural substances as alternatives or in combination with AGPs has thus become increasingly interesting for profitable and sustainable broiler production.

Wood lignans as a natural support for gut health

Lignans are natural polyphenols found in many plants. In plants,

Figure 1: The blue color is evidence of a damaged intestinal barrier. The number of smurf flies was reduced by addition of wood lignans ($p < 0.0001$).



they exert protective effects against infections. For the use of wood lignans in animals, anti-inflammatory and antioxidative effects have been scientifically described: They decrease gene expression of various pro-inflammatory cytokines and can limit the extent of oxidative challenge.

A product based on wood lignans (agromed ROI) has shown substantial positive effects on inflammation parameters, gut health, and performance in basic research trials and in broiler production.

Trial results

In vitro LPS challenge

In an *in vitro* test system THP1 cells were incubated with lipopolysaccharide (LPS) as proinflammatory challenge (Table 1).

The pro-inflammatory parameters interleukin 6 (IL-6), IL-1β, IL-8 and tumor necrosis factor (TNF) increased significantly compared to the control. In all cases, the addition of wood lignans significantly reduced this effect.

Intestinal barrier integrity – fruit flies

In a test system with *Drosophila melanogaster* (fruit fly), dextran sodium sulphate (DSS) was added to the feed to compromise intestinal integrity. Additionally the feed was supplemented with Brilliant Blue dye. The blue color passed through the damaged intestinal wall and stained flies blue. This resulted in so-called "smurf flies". The addition of wood lignans to the feed significantly reduced the proportion of smurf flies (Figure 1).

Table 2: Feeding trial, Thailand*.

	Control	Zn-bacitracin (20 ppm)	Wood lignans (ppm)	
			200	400
BW d 42 (kg)	2.53	2.56	2.59	2.61
Feed intake (kg)	4.17	4.18	4.22	4.22
FCR	1.678	1.664	1.659	1.646
Litter score**	2.25	2.13	2.06	2.00
Litter moisture (%)	22.8	22.4	21.5	21.2

*8 pens/group; 12 Ross 308 males/pen; maximum temperature 32 °C from 8-42 d; 12 birds/m²

**Litter score: 1 = good (no caking, light brown, quite dry), 2 = fair (some caking, brown, quite wet), 3 = poor (caking, dark brown, wet)

Table 3: Feeding trial, Brazil*.

	Control	Virginiamycin (16.5 ppm)	Wood lignans (400 ppm)	Virginiamycin + Wood lignans
BW d 42 (kg)	2.58 ^a	2.59 ^a	3.09 ^b	3.03 ^c
Feed intake (kg)	4.35 ^A	4.33 ^B	4.51 ^C	4.61 ^D
FCR	1.71 ^a	1.68 ^b	1.46 ^c	1.52 ^d
Litter moisture (%)	25.9	25.4	24.6	25.3

*8 pens/group; 13 Cobb 500 males/pen

^{a,b,c} significant differences $p < 0.001$; ^{A,B,C,D} significant differences $p < 0.05$

Broiler feeding trials

In a feeding trial at the Bangkok Animal Research Centre, Thailand, the influence of Zn-bacitracin and wood lignans on litter quality and performance was evaluated (Table 2). Heat stress is a noteworthy problem for animal production in many countries and makes economic production challenging. Heat stress is often used as a trigger to underline effects on inflammation as it triggers the release of free radicals in the intestinal mucosa and in various organ tissues.

Another experiment at the University of Sao Paulo (Brazil) confirmed these results (Table 3).

Conclusion

As the industry has been looking for suitable replacements for AGPs, wood lignans are promising candidates. The trials presented show that by relieving intestinal stress, performance can be substantially improved, in some cases highly significantly. This is shown in comparison to negative controls, as well as in comparison to or in combination with AGPs.

Intestinal health is of great importance in order to better exploit the genetic performance potential. Hence, supplementing commercial broiler diets with wood lignans is regarded a valuable strategy to support performance and profitability in poultry production. **Ap**

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