Natural resin acid contributes to improved broiler performance

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Rosin, a major source of resin acids, is a compound that is secreted by coniferous trees at the site of mechanical injury against pathogenic bacteria, fungi and parasites. Resin acids have not commonly been used in animal feeds but are consumed by many wild herbivores, such as moose.

Resin acids have been shown to contain antibacterial, antifungal and antiparasitic properties, Gram positive bacteria being especially sensitive.

Folk medicine in Nordic countries has used rosin to heal infected wounds for centuries and the same effects have been proven by scientific research in recent years.

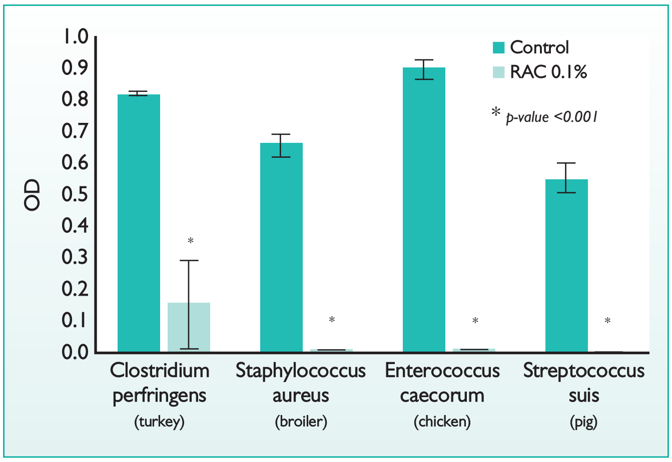

Fig. 1. The effect of RAC on the growth of pathogenic Gram positive bacteria in vitro (Alimetrics Ltd 2014). Clostridium perfringens was measured at five hours, Staphylococcus aureus and Enterococcus caecorum at eight hours, and Streptococcus suis at 10.5 hours.

Tested efficacy

The inclusion of natural resin acid composition (RAC) in feeds has been shown in trials to reduce the growth of pathogenic Gram positive bacteria in vitro, modulate the composition of intestinal microbiota and improve the growth performance of broiler chickens.

The tested resin acid composition (Progres, Hankkija Ltd/Suomen Rehu, Finland) was produced from crude tall oil, a by-product of the cellulose industry. Depending on the experiment the RAC product contained from 4-8.5% resin acids, 88.5 -94% free fatty acids and 2-3% neutral components.

RAC was shown to reduce the growth of a pure culture of Clostridium perfringens in vitro measured by optical density of the growth medium.

Similar growth inhibition of Clostridium perfringens was also seen as measured by CFU in a broth dilution method, and by zone of inhibition using an agar diffusion method.

In studies conducted by Alimetrics Ltd, RAC, at or above 0.1% concentration in the growth medium, significantly reduced the growth of Clostridium perfringens, Enterococcus caecorum, Staphylococcus aureus and different pathogenic Streptococcus species including Streptococcus suis (Fig. 1).

Resin acid composition improved the growth performance of broilers in challenging and normal conditions.

Challenge trials

In a challenge trial (Trial 1) inducing clinical necrotic enteritis (NE) RAC dose dependently improved the body weight of broilers during the trial and tended to improve feed conversion ratio in the pre-challenge period.

RAC also tended to reduce mortality and shifted the ileal fermentation from homo-lactic to hetero-lactic direction both in the in vivo study and in an ex vivo laboratory fermentation model.

A similar shift in the ileal fermentation of broilers has been observed with AGPs and this may partly explain the observed performance enhancing effect of RAC.

A similar challenge trial (Trial 2), which induced sub-clinical NE,

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Table 1. The effect of RAC on broiler performance in a challenge trial (Van Eerden et al. 2015). ^{a,b,c}***values without a common superscript within a row indicate significant differences.***

Treatment	Control		RAC			P-value
	Infected	Non-infected	1	2	3	
NE challenge	yes	no	yes	yes	yes	
RAC (kg/ton)	0	0	1	2	3	
Resin acids (mg/kg)	0	0	80	160	240	
Day 9-35						
BWG (g)	1875^{a}	2190^{c}	2070^{bc}	2047^{bc}	2016^{ab}	0.02
FI (g)	2896^{a}	3269^{bc}	3357^{c}	3035^{ab}	2986^{ab}	0.04
FCR (kg/kg)	1.522	1.484	1.627	1.479	1.476	0.20
Day 35						
BW (g)	2094^{a}	2418^{c}	2294^{bc}	2261^{abc}	2229^{ab}	0.03

Table 2. The effects of RAC on broiler performance (Private Research Farm UK 2014, Alimetrics Ltd 2015). ^{a,b}***values without a common superscript within a row indicate significant differences in a trial. *50% silicate carrier.***

Treatment	Trial 3 UK			Trial 4 Alimetrics			
	Ctrl	RAC	P-value	Ctrl	RAC liquid	RAC dry*	P-value
Anticoccidial	yes	yes		no	no	no	
RAC (kg/ton)	0	0.5		0	0.75	1.50	
Resin acids (mg/kg)	0	40		0	60	60	
Day 14							
BW (g)	480^{a}	499^{b}	<0.05	443^{a}	490^{b}	498^{b}	<0.001
FCR (kg/kg)	1,142	1,143	NS	1,230	1,230	1,210	NS
Day 37 (35)							
BW (g)	2113	2145	NS	2330^{a}	2556^{b}	2542^{b}	<0.001
FCR (kg/kg)	1,571^{a}	1,513^{b}	<0.05	1,580	1,540	1,560	NS

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reported that RAC significantly improved the body weight gain (BWG) of broilers during the trial period.

The difference in the average BWG with two lowest RAC doses compared to infected control was 195g/day and 172g/day, respectively (Table 1).

The improved body weight gain of the RAC treatments in this experiment was accompanied by a higher feed intake and therefore did not result in a better FCR. Reduced feed intake of challenged birds is typically an indication of a compromised health status.

The increased feed intake of the RAC fed chickens may suggest less intestinal disturbances. The highest dose of RAC did not significantly improve the production performance, which is in contradiction to a previous study with the same product and dose level. The challenge in these two studies induced different levels of infection.

It may be that the highest dose of RAC in this study also affected potentially beneficial bacteria resulting in a lower performance response than the lower doses.

Performance trials

The effect of RAC on the performance of broilers in commercial production conditions was tested at a private research farm in the UK (Trial 3).

In this trial RAC was tested at 0.5kg/ton of feed compared to a control group. Both trial groups were fed with typical commercial diets containing anticoccidial (robenidine + monensin).

Ross 308 chickens were allocated to six replicate pens per treatment and there were 324 chickens in each pen. The stocking density reached 38kg/m^2. The body weight of the RAC fed chickens was numerically higher throughout the trial, although being statistically significant only at day 14 (Table 2).

At the end of the trial (day 37) chickens in the RAC group were on average 32g heavier than the control.

RAC improved the feed conversion ratio ($p<0.05$) during the whole trial period, giving an advantage of 0.06kg/kg live weight.

A trial conducted by Alimetrics Ltd in Finland (Trial 4) investigated the effect of RAC in its original liquid form (RAC liquid) and also a dry version (RAC dry) with the liquid absorbed into 50% silicate carrier on broiler performance.

The basic diet was a wheat-soy based feed without coccidiostat. Ross 508 male broilers were used in this trial and allocated to 12 replicate pens per treatment with 15 birds per pen.

RAC inclusion significantly improved the body weight of broilers versus the control for both test treatments at day 14 and day 35 (Table 2). At the end of the trial the difference in body weight to control was 226g and 212g respectively for RAC liquid and RAC dry. The RAC fed chickens also consumed more feed and therefore did not have significantly better FCR.

Table 3. Summary of results from the presented in vivo trials.

Significantly p<0.05	Trial 1 (Kettunen et al. 2015)	Trial 2 (Van Eerden et al. 2015)	Trial 3 (Private research farm UK 2014)	Trial 4 (Alimetrics Ltd 2015)
Improved BW or BWG	yes	yes	yes	yes
Improved feed intake		yes		yes
Improved FCR	yes (p = 0.06)		yes	

Remarkable potential

The conducted research has shown that RAC contributes to an improved production performance of broilers (Table 3) and thus has an improved profitability of production.

The commercial experience of using the product for turkeys and broilers in Finland strongly agrees with this.

Trials with other animal species, including calves and piglets, have been started. Initial results from these studies are promising and show that RAC has a potential for a wide range of applications. ■

References are available from the author on request
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