Effect of glycerides and free short chain fatty acids replacing avilamycin in the diet of broiler chickens

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Abstract
Two hundred Ross 508 chickens were allotted to 5 dietary treatments: avilamycin, butyric triglyceride, butyric caprylic and capric triglyceride, butyric glyceride plus free caprylic and capric acids and a control. The birds were challenged with coccidia and *Clostridium perfrigens* at day 21, when the glyceride and acidic supplementation ceased. Triglycerides had the same growth promoting effect as the antibiotic, lasting two more weeks after the suspension. It is concluded that the glycerides of short chain fatty acids may replace avilamycin and that the treatment may be stopped two weeks before slaughter.

Introduction

The use of antibiotics as growth promoters in animal feeding will be banned in the European Union starting from January 2006. Hence the need of finding out alternative molecules which may face the correct development of intestinal microflora, so preventing intestinal diseases such as coccidiosis and clostridiosis, become relatively common with poultry.
A recent review by Józefiac et al. (2004) dealing with the fermentation of structural carbohydrates in the caeca of chickens, leading to short chain fatty acids (SCFA, butyric to caprylic and capric), acknowledges these acids as potent inhibiting factors of some pathogenic bacteria and as growth promoting agents of other beneficial bacteria as *Lactobacillus* and *Bifidobacterium* genera. Such actions are acknowledged by Isolauri et al. (2003) as well. Among SCFA, butyric acid is considered quite an important molecule for its nutraceutical preventing action against a series of intestinal diseases, from inflammation to diarrhoea, ending with heavier health problems. In fact, butyric acid, the major energy source to enterocytes, is essential to the health of intestinal mucosa (Isolauri et al., 2003). Van Immerseel et al. (2004) have been studying the effect of butyric acid as a feed supplement to control *Salmonella enteriditis* in poultry, with excellent results.
Given the two premises: i) the need of finding out novel alternatives to the use of antibiotics as growth promoters and ii) the possibility of using molecules which are naturally formed in the gut as fermentation products, aim of the present research project was focalizing the conditions of practical application of SCFA as feed supplements in broilers' diets. Since free butyric acid, because of its terrific, penetrating odour, is practically impossible to be handled by feed manufacturing plants, the additive used in the present experiment was under the form of butyric glyceride.

Materials and Methods

Diets: based on maize meal and soybean meal (table 1), were formulated in two versions: the starter for the first two weeks and the finisher. The control diet contained no additive; the medicated diet contained avilamycin (10 ppm on the complete feed mixture). The other 3 diets (treatments 1, 2 and 3) were supplemented only in the case of the starter version: treatment 1 with butyric triglyceride (0.2%); treatment 2 with butyric (0.2%), caprylic and capric triglycerides (0.15%) and treatment 3 with butyric triglyceride (0.2%) and free caprylic and capric acids (0.1%). Each week total feed intakes per group were recorded.
Birds: 40 Ross 508 hybrid male chickens per group, vaccinated against coccidiosis at birth. At the end of the third week all the birds were infected *per os* with oocysts of *Eimeria acervulina* and *maxima* (10^3/g each) and *Clostridium perfrigens* ($5 \cdot 10^5$ CFU). Each week all the birds

were individually weighed, 3 of them per group were sacrificed and their intestine examined for coccidia, Clostridium and lesions (results not reported in the present paper).

Results and Discussion

Table 2 gathers the weight gains and the feed/gain ratios from the start up to 42 days, with the statistical significance of differences, if any. But better than the table, the graph of figure 1 is more immediately self explanatory.

For the first 21 days, before the artificial infection, all the groups had comparable weekly gains. The challenge had an important effect on gains and on feed/gain ratios during the fourth week: avilamycin and treatments 1 and 2 allowed the birds to maintain steady gains, but both the control and treatment 3 did not. It must be stressed that, while avilamycin was still present in the feed, there was no longer any fatty acid supplementation to the other diets. There is a clear evidence that the coverage effect of glycerides lasted even after the treatment ceased. And lasted for one more week, then the two treatments 1 and 2, which had been the best ones, turned to be the worst ones, while avilamycin maintained its growth promoting effect.

Conclusion

Although preliminary, the results indicate that:

- triglycerides of butyric acid and of caprylic and capric acids may replace antibiotics such as avilamycin as growth promoters in the diet of broiler chickens;
- the supplementation may be interrupted two weeks before slaughter, with no adverse live performance.

References

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Table 1 – Diets composition (%)

ingredient	starter (0-14 d)	finisher
maize	52.00	58.00
soy bean meal 48	35.50	31.00
maize gluten feed	3.00	-
$CaHPO_4 \cdot 2H_2O$	1.90	1.90
$CaCO_3$	1.50	1.20
$NaHCO_3$	0.25	0.25
NaCl	0.25	0.25
DL methionine	0.25	0.25
lysine HCl	0.15	0.15
choline	0.15	0.15
mineral vitamin supplement	0.50	050
olive oil	4.50	6.30

Table 2 – Weekly weight gains and feed/gain ratios

	diets					
	control	avilamycin	treatm. 1	treatm. 2	treatm. 3	SE
0-7 d						
weight gain, g	57^{A}	64^{B}	60^{AB}	65^{B}	50^{C}	1.9
feed/gain	1.48^{A}	1.49^{A}	1.29^{B}	1.27^{B}	1.43^{AB}	0.05
8-14 d						
weight gain, g	193^{A}	178^{B}	196^{A}	193^{A}	171^{B}	4.0
feed/gain	1.42^{A}	1.62^{B}	1.42^{A}	1.42^{A}	1.56^{B}	0.03
15-21 d						
weight gain, g	299^{a}	297^{A}	319^{Bb}	326^{B}	318^{Bb}	5.6
feed/gain	1.62^{a}	1.60	1.60	1.56	1.49^{b}	0.04
22-28 d						
weight gain, g	254^{A}	292^{B}	324^{C}	328^{C}	265^{AB}	14.9
feed/gain	2.64^{A}	2.41	2.13^{B}	2.23	2.43	0.16
29-35 d						
weight gain, g	435^{a}	454	472	491^{b}	430^{a}	18.3
feed/gain	2.32^{ab}	2.51^{Aac}	1.73^{Bd}	1.94^{bd}	2.26^{bd}	0.18
36-42 d						
weight gain, g	576^{A}	626^{Ba}	553^{AC}	511^{C}	574^{Ab}	16.9
feed/gain	2.12	2.10	2.25^{A}	2.21^{A}	1.94^{B}	0.07

within a row, means with different superscript letter differ (capital letter, $p<0.01$; small letter, $p<0.05$)

Figure 1 – Weekly daily gains