Proceedings 5th World Rabbit Congress,25-30 July 1992, Corvallis – USA, 1270-1277.

FLAVOMYCIN FOR EARLY WEANED RABBITS : RESPONSE OF DOSE ON ZOOTECHNICAL PERFORMANCES - EFFECT ON NUTRIENT DIGESTIBILITY

L. Maertens[1], Moermans R.[2] and G. De Groote[1]

Government Agricultural Research Center Ghent
[1]Research Station for Small Stock Husbandry
[2]Institute for Applied Biometrics and Statistics
Burg. Van Gansberghelaan, 92
9820 Merelbeke, Belgium

Abstract

In a 6 weeks experiment, involving 288 four-week-old-weanlings, the effect of increasing doses (0, 4, 8 and 16 mg/kg) of Flavophospholipol (FPL) was investigated. Equal numbers of both sexes were used to study the effect on the zootechnical performances. They were fed a moderate protein and rich fibre diet ad libitum. Slaughter yield was determined on 10 males and 10 females of the control and the FPL4 treatment as well. Furthermore a digestibility trial was performed with seven-week-old-rabbits in order to investigate the effect of FPL on nutrient digestibility.

Results showed a high, but comparable daily weight gain for the whole period: 42.0, 41.7, 41.6 and 41.9 g on diets 0, 4, 8 and 16 mg/kg, respectively. Feed intake was always lower on the FPL diets and consequently a more favourable ($p < .001$) feed efficiency of about 5% was obtained compared to the control diet. No indication of dose related effects could be demonstrated. Because of decreased feed intake, especially during the first week post-weaning, early growth data were somewhat negatively influenced by FPL treatment. However rabbits compensated afterwards fully this growth depression.

No effect of FPL treatment was observed on slaughter yield data. Dressing percentage was 61.7 (control group) and 62.0% (FPL 4), respectively.

The digestibility trial revealed a slight, but non significant, improvement of the digestibility of the non-fibrous fractions in favour of the FPL 4 diet. The observed increase of the digestible energy content could explain only partly the favourable effect on feed efficiency with FPL.

1. Introduction

Several trials have clearly demonstrated the beneficial effect of Flavophospholipol (FPL) on the zootechnical performances of broiler rabbits (Schlolaut & Lange, 1973; Bombeke et al., 1976; Damian et al., 1982; Rebdini et al., 1982). The inclusion level in these experiments was always 4 or 8 mg/kg. However a dose response effect was never investigated. Furthermore the performance level of the rabbits used was moderate.

Therefore the purpose of the experiment was to evaluate the actual effect of increasing doses of FPL on the performances of fast growing meat rabbits. Because of the favourable effect on feed conversion, in addition a digestibility trial was performed.

2. Materials and Methods

2.1. Experimental animals and housing

Four week-old rabbits belonging to the Institute's own selected strain were housed in a separate compartment on flat-deck cages of an experimental rabbit house. In total about 340 end products of the final cross (a dam line x a sire line) were weaned on the same day. Only weanlings with a weight between 550 and 720 g were taken into account. Out of them, 288 sexed rabbits were chosen for the fattening trial and transported to the experimental room. Equal numbers of males and females were assigned to four treatment groups (2 x 12 replicates). To exclude litter effects, litters were proportionally divided over the experimental groups. All rabbits received a numbered ear tag.

Heated air and artificial ventilation was used to create optimal environmental conditions (18 ± 2°C). Rabbits were hold with three on wire mesh cages measuring 60 x 43 cm. Each cage was equipped with a nipple drinker and a 12 cm wide, outside placed feeder.

2.2. Diets

Diets were prepared at the Institute. To exclude non-homogeneity of the raw materials used, only one batch of the total feed quantity was prepared. Afterwards 10 kg of the meal was used as premix together with the delivered FPL 8% premix, in order to prepare the experimental diets with supplementation levels of 4; 8 and 16 mg/kg. The standard basal diet (Table 1) was calculated according to the most recent recommendations for broiler rabbits (Lebas, 1989). All diets were pelleted (3.4 x 10 mm) and fed always *ad libitum*.

Before weaning, kits received all the same diet (standard reproduction).

2.3. Recordings

Individual weight gain and cage feed intake were measured after 1; 2; 4 and 6 weeks. Dead rabbits were immediately cooled and at the end of the experiment autopsied by Dr. Peeters (National Institute for Veterinary Research).

For the calculation of the feed intake and feed conversion per cage, a correction for mortality was performed. We assumed that on average the last two days before they died, feed intake was negligible. Taking this in account, the average daily feed intake per rabbit was calculated in the cage, where mortality occurred. As well daily weight as feed consumption of the dead animals was excluded.

2.4. Slaughter experiment

At the end of the fattening period 10 males and 10 females both from the control and the 4 ppm group as well were slaughtered. Only the middleweight rabbit of each cage was chosen for slaughtering. No fasting period was performed before slaughtering.The following definitions were used to calculate the different dressing percentages:

Carcass weight (hot): live weight - (skin + gastrointestinal tract + blood + fore legs)

Commercial carcass weight: hot carcass weight - (lungs + oesophagus + trachea + hind legs)

Net carcass weight: commercial carcass - (head + liver + kidneys + perirenal and scapular fat)

2.5. Digestibility experiment

The digestibility test was performed in accordance with the recommended methodology (Maertens & Lebas, 1989). Six, seven-week-old rabbits, individually caged, were used for each diet. After an adjustment period of 8 days to diet and digestibility cages, the 7 days collection period was performed.

Only diets with 0 and 4 ppm FPL were tested.

2.6. Statistical analysis

Zootechnical data were analyzed by split-plot analysis of variance with subunits sex and treatment. Dose effects were studied with regression analysis.

Slaughter and digestibility data were analysed by analysis of variance.

3. Results and discussion

The ingredient and chemical composition of the standard diet is given in Table 1. Samples of this diet and the supplemented diets (4; 8 and 16 mg FPL/kg)were assayed on their FPL content (by Hoechst AG, Abt. Produktentwicklung Tiergesundheit). Results indicated a correct inclusion level: 0; 3.7; 8.5 and 15.6 mg/kg, respectively.

3.1 Zootechnical performances

Daily weight gain (DWG), feed intake (DFI) and feed efficiency (FE) are presented in Tables 2, 3 and 4, respectively. Addition of FPL resulted in a significant lower DWG during the first fattening week after weaning. However all supplemented diets showed a compensatory growth between day 42 and 56. Finally DWG for the total period was comparable: 42.0, 41.7, 41.6 and 41.9 g, respectively. It has been shown that a moderate DWG, during early fattening period, can help to control digestive disorders (Morisse, 1985).

Feed intake of the non-treated rabbits was always higher, especially in the first week, which explains the already mentioned decreased DWG. At the end of the fattening period, the average DFI was about 5% lower ($p < .01$) in all FPL groups.

Supplementation with FPL had a favourable effect ($p < .001$) on feed efficiency. Differences were most pronounced during the 3rd period (week 6 and 7). This could be explained both by the decreased DFI and the increased DWG as well. Overall FE was 3.25, 3.11, 3.13 and 3.10 for the control and FPL diets respectively. A dose effect was not observed.

In the second half of the fattening period a significant effect of sex was found. DWG of females as well DFI were lower ($p<.05$ and $p<.01$, respectively) while FE was less favourable ($p<.05$). But the interaction sex x FPL was always not significant.
As shown in Table 5, mortality was low. Most rabbits died one week post-weaning of enterotoxemia. Autopsy revealed the occurrence of a *Clostridium spiroforme* proliferation. Partly because of the small numbers of dead rabbits, diet related effects were not clear.
In our study, the favourable effect of FPL was emphasised only on the FE. In other studies (Damian et al., 1982; Rebdini et al., 1982, Bombeke et al., 1976) FE and DWG as well were positively influenced by FPL supplementation. The absence of an FPL effect on the overall DWG results in our study are probably due to the decreased DFI. However, this fact was not confirmed in a recent parallel study of Hartmann (1991). This suggest that diet related factors (feed composition) could influence the results of FPL supplementation.

3.2. Slaughter yield

Differences between slaughter yield were small and not significant (Table 6). Slaughter yield (hot) was respectively 61.7 (control diet) and 62.0% (FPL4 diet). A slight tendency for a heavier liver weight was observed for FPL rabbits. Perirenal and scapular fat were comparable for both treatments. Does tended to have somewhat higher fat deposits.

3.3. Nutrient digestibility

The diet used had a moderate protein content and a rather high fibre content. With exception of the fibrous fractions a slight, but non significant, improvement of the digestibility was determined for the FPL4 diet (Table 7). When the analysis scheme of Van Soest was used, the same tendency was observed: a slight improvement for the well digested fractions (NDS, NDF and hemicellulose). Fibrous fractions tended to be somewhat less digestible when 4 ppm FPL was added.
The dietary differences in digestible energy could explain only a small part of the favourable effect of FPL on FE. A difference of 1 MJ digestible energy results in a difference of 0.33 in FE (Maertens & De Groote, 1987). The control and the FPL 4 diet differed 0.14 in FE (Table 4) corresponding to an increase of 0.42 MJ (100 kcal) in favour of the FPL diet. However, the digestibility trial revealed a difference of only 1/5 of this amount.
Other explanations of their mode of action must be centred on activity within the gut because Flavomycin is largely unabsorbed from the intestine. Several mechanism are proposed (see review of Boorman, 1987) as 1. inhibition of specific deleterious organisms, 2. inhibition of digestible nutrient loss and, 3. effects on the gut wall. Recently, even a reduced fasting heat production was observed with hens on a Zinc Bacitracin supplemented diet (Männer & Wang, 1991)

Acknowledgement

Appreciation is expressed to Hoechst AG, Frankfurt, for the financial assistance and especially to dr. W. Sambeth for advices during the experiment and the preparation of this paper.

The authors express also appreciation to Mr. Andre Vermeulen for the technical assistance and to R. Lemmens and R. De Temmerman for carying the rabbits.

References

BOMBEKE, A., OKERMAN, F., DE GROOTE, G., MOERMANS, R.J., 1976. De invloed van de antibiotica flavomycine en spiramycine op de groei, de voederomzetting en de leefbaarheid bij slachtkonijnen. Landbouwtijdschrift, **29**, 1481 - 1499.

BOORMAN, K.N., 1987. Mode of action of gut-active (antibiotic) performance promoters. Proceedings 6th European Symposium on Poultry Nutrition, Königslutter, D12-D19.

DAMIAN, C., MARTINA CONSTANTA, CIUREL, V., 1982. Influenta unor nivele de flavomicina in ingrasarea iepurilor. Lucrarila Stntifice ale Institutului de Cercetari pentru Nutitie Animamla, **11**, 209 - 214.

HARTMANN, 1991. Personal communications.

LEBAS, F., 1989. Besoins nutritionelles des lapins. Revue bibliographique et perspectives. Cuni-Sciences, **5**, 1 - 28.

MAERTENS, L., DE GROOTE, G., 1987. Quelques caractéristiques spécifiques de l'alimentation des lapins. Revue de l'Agriculture, **40**, 1186 - 1205.

MAERTENS, L., LEBAS, F., 1989. Energy evaluation of rabbit feeds and feedstuffs. A critical approach. Cuni-Sciences, **5**, 35 - 46.

MÄNNER, K., WANG, K., 1991. Effectiveness of zinc Bacitracin on production traits and energy metabolism of heat-stressed hens compared with hens kept under moderate temperature. Poultry Science, **70**, 2139 - 2147.

MORISSE, J.P., 1985. Controle de la pathologie digestive. Essais de mise au point d'un aliment adapté au sevrage. L'Eleveur de lapins, n° 22, 29 - 31.

REBDINI, O., GALAZZI, D., VALERANI, L., 1982. L'impiego del Flavofosfolipol (FPL) quale fattore di crescita nel mangime di conigli all'ingrasso. Rivista di Coniglicoltura, **XIX**, 57 - 60.

SCHLOLAUT, W., LANGE, K., 1973. Der Einfluss von Flavomycin auf die Mast- und Schlachtleistung von Jungmastkaninchen. Archiv für Geflügelkunde, **37**, 69 - 71.

Table 1. Ingredient and chemical composition (%/kg) of the basal diet

Ingredients		Composition[1]	
Alfalfa meal 16	27.5	Dry matter	90.4
Wheat shorts	30.0	Crude protein	15.7
Sunflower meal 29	9.3	Crude fat	3.9
Soybean meal 44	6.5	Crude fibre	17.3
Wheat	7.0	ADF	21.7
Flax chaff	6.0	NDF	35.7
Cassava meal	5.5	ADL	7.3
Renderers fat	1.1	Lysine (calculated)	0.75
Molasses	4.0	Ca (calculated)	1.26
L-Lysine-HCl	0.04	P (calculated)	0.74
DL-Methionine 98	0.04	Digestible energy	
Vit.-Min. mix	3.0	kcal/kg	2270
Robenidine 6%	0.1	MJ/kg	9.50

[1] analyzed, unless otherwise stated

Proceedings 5th World Rabbit Congress, 25-30 July 1992, Corvallis – USA, 1270-1277.

Table 2. Influence of FPL on daily weight gain (mean ± SEM).

Diet	0 FPL	4 FPL	8 FPL	16 FPL	Statistical analysis Sex	FPL	Sex x FPL
Initial weight (g)	630 ±9.2	628 ±6.7	630 ±8.2	629 ±6.9	-	-	-
Daily weight gain (g) between:							
28 - 35d	40.4^{Aa} ±0.9	36.6^{ABbc} ±1.1	34.5^{Bb} ±1.4	37.6^{ABac} ±1.0	NS	**	NS
35 - 42d	40.6 ±1.2	39.9 ±1.5	40.2 ±1.5	37.3 ±1.6	NS	NS	NS
42 - 56d	44.0 ±1.0	45.7 ±0.8	45.6 ±1.0	46.8 0.8	NS	NS	NS
56 - 70d	41.6 ±1.1	41.3 ±0.9	41.8 ±1.1	41.4 ±0.9	**	NS	NS
Mean of the total period:							
28 - 70d	42.0 ±0.6	41.7 ±0.4	41.6 ±0.5	41.9 ±0.5	NS	NS	NS

*: $p<.05$ **: $p<.01$ ***: $p<.001$

A,B: effect FPL, means not having a common superscript letter differ (lowercase $p<.05$; uppercase; $p<.01$)

Table 3. Influence of FPL on daily feed intake (mean ± SEM).

Diet	0 FPL	4 FPL	8 FPL	16 FPL	Statistical analysis Sex	FPL	Sex x FPL
Daily feed intake (g) between:							
28 - 35d	79.8^{A} ±1.4	70.1^{B} ±1.1	69.4^{B} ±2.0	69.8^{B} ±1.4	NS	***	NS
35 - 42d	108.7^{Aa} ±1.8	102.0^{ABb} ±2.1	102.4^{ABb} ±2.0	98.8^{B} ±2.1	NS	**	NS
42 - 56d	145.2 ±2.5	139.9 ±2.0	138.1 ±2.6	141.3 ±2.1	*	NS	NS
56 - 70d	170.1 ±2.7	163.6 ±2.8	166.2 ±2.5	163.7 ±2.6	*	NS	NS
Mean of the total period:							
28 - 70d	136.5^{A} ±1.5	129.8^{B} ±1.5	130.1^{B} ±1.7	129.8^{B} ±1.6	NS	**	NS

see table 2

Table 4. Influence of FPL on feed efficiency (mean ± SEM).

Diet	0 FPL	4 FPL	8 FPL	16 FPL	Statistical analysis Sex	FPL	Sex x FPL
Feed efficiency between:							
28 - 35d	1.99[ab] ±0.03	1.95[ab] ±0.06	2.06[a] ±0.06	1.87[b] ±0.03	NS	*	NS
35 - 42d	2.71 ±0.06	2.62 ±0.08	2.63 ±0.10	2.72 ±0.08	NS	NS	NS
42 - 56d	3.33[A] ±0.07	3.07[B] ±0.04	3.04[B] ±0.05	3.03[B] ±0.04	NS	***	NS
56 - 70d	4.12 ±0.06	3.98 ±0.07	4.01 ±0.07	3.98 ±0.06	*	NS	NS
Mean of the total period:							
28 - 70d	3.25[A] ±0.03	3.11[B] ±0.02	3.13[B] ±0.03	3.10[B] ±0.02	NS	***	NS

see table 2

Table 5. Mortality and autopsy data.

Diet	0 FPL	4 FPL	8 FPL	16 FPL
Mortality				
Number of rabbits	4	5	2	2
As %	5.6	6.9	2.8	2.8
Autopsy				
Pneumonia	-	-	-	2
Cryptosporidium	1	-	-	-
C. Spiroforme	3	4	2	-
Invagination of the small intestine	-	1	-	-

Proceedings 5th World Rabbit Congress, 25-30 July 1992, Corvallis – USA, 1270-1277.

Table 6. Slaughter yield of rabbits on the control and FPL 4 diet (mean ± SD).

FFP	0 ppm		4 ppm	
	Males	Females	Males	Females
Live weight (g)	2672±122	2641±151	2683±131	2621±110
Carcass weight (g)	1650±86	1626±85	1678±83	1608±70
Skin + fore legs (g)	410±39	400±40	408±27	409±29
Fat (g)	50±16	57±14	49±12	60±17
Liver (g)	95±10	99±15	102±14	104±18
Slaughter yield (%)				
hot carcass	61.7±0.8	61.6±2.0	62.6±0.9	61.3±1.1
commercial carcass	52.5±1.0	52.6±1.7	53.3±1.2	52.1±1.0
net carcass	48.3±1.0	48.5±1.7	49.1±1.1	48.0±0.9

Differences between treatments are not significant

Table 7. Digestibility (mean ± SD) of the control and FPL 4 diet

	Analysis	Digestibility coefficients*(%)	
	(%/kg)	control	FFP 4
Dry matter	90.4	56.6 ±0.8	57.0 ±0.4
Organic matter	83.0	57.2 ±0.7	57.6 ±0.4
Crude protein	15.7	69.8 ±0.9	70.7 ±1.8
Crude fat	3.9	74.3 ±1.1	75.9 ±2.3
Crude fibre	17.3	16.2 ±3.9	14.0 ±3.7
NFE	46.1	66.9 ±1.5	68.0 ±1.1
Gross energy,kcal (MJ)/kg	4054 (16.96)	56.0 ±0.8	56.5 ±0.4
NDF	35.7	23.7 ±1.4	23.9 ±1.2
NDS	64.3	77.0 ±0.7	77.6 ±0.6
ADF	21.7	15.4 ±2.0	14.1 ±1.1
ADL	7.3	15.8 ±1.8	12.4 ±4.7
Hemicellulose	14.0	36.7 ±1.1	39.0 ±2.3
Cellulose	14.4	15.2 ±2.4	15.0 ±2.5

* Differences between diets are not significant