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EFFECT OF DIETARY FIBRE AND ENERGY CONTENT ON MORTALITY AND GROWTH PERFORMANCES OF RABBITS IN CASE OF EPIZOOTIC RABBIT ENTEROCOLITIS

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ABSTRACT

The aim of this trial was to investigate the effect of the dietary fibre and energy level on the performances of 672 fattening rabbits from 35 to 72 days of age. There were 4 treatments with two levels of energy (low, 2350 Kcal/kg or high, 2550 Kcal/kg) and two levels of fibre for each energy level (2 points of difference for crude fibre level). A therapeutic antibiotic treatment was perfomed in the drinking water (2 x 5 d) against epizootic rabbit enterocolitis. There was no statistical difference between treatments at 72 days of age on mortality (mainly due to epizootic rabbit enterocolitis) but the treatment 2 (low energy – low fibre) had the lowest mortality : 13.1 % compared to the average of the trial (18.3%). Energy level had a statistically significant effect on feed intake and feed conversion index : 3.26 for 2550 Kcal/kg against 3.46 for 2350 Kcal/kg. Fibre level had a statistically significant effect on weight and growth performances which resulted in 70 g higher weight at 72 days for rabbits receiving the high fibre diet.

INTRODUCTION

Fibre represents around one third of the diet and has a positive effect on digestive security for the rabbit. Actually, a decrease of fibre level in diet leads to an increase of risk of digestive disorders through the decrease of volatile fatty acids concentration in the caecum (De Blas, 1999). This positive effect of fibre has mostly been studied in case of diarrhoea (Perez, 1996). Nowadays, in France, rabbit farmers have important losses of rabbits by epizootic rabbit enterocolitis and the major aim of this trial was to test the effect of fibre level on mortality caused by epizootic rabbit enterocolitis. On the other hand, to have good feed conversion index, rabbits need diet with high energy level. But high energy level means low fibre level (unless it is possible to add fat, but it usually deteriorates the hardness and the durability of pellets). That's why two levels of fibre and two levels of energy in fattening diets were tested in order to study their effect on mortality caused by epizootic rabbit enterocolitis and on growth performances, feed conversion index and dressing percentage.

MATERIALS AND METHODS

The trial was conducted at the Research and Experimentation Centre of the Glon-Sanders Group in Sourches (France) from the 11th of May to the 17th of June 1998.

Animals and housing

672 Hyplus weaned rabbits from the rabbitry of the centre were housed in a windowless building with an artificial photoperiod of 8 hours of light and 16 hours of darkness. Minimum temperature was 18.3°C $\pm$ 1.1 and maximum temperature was 27.1°C $\pm$ 3.2 in average, with a ventilation system by extraction. There were 7 rabbits per flat-deck cage (density 16.6 rabbits/m²). 672 rabbits were weighed by litter of

7 rabbits (after elimination of the smallest and/or the biggest rabbit of the litter if there were more than 7 rabbits/litter). The litters were alloted by their initial weight (4 groups: under 1011 g ; from 1011 g to 1076 g; from 1076 g to1134 g ; upper 1134 g), the number of the buck and the lactation range of the doe. Each litter (of 7 rabbits) was assigned to one treatment among 4, with 24 cages replicate per treatment.

Diet

The diets (Tables 1 and 2) differed by the energy and the fibre levels. The first group received a diet low in energy and in fibre, the second group received a diet low in energy and high in fibre, the third group received a diet high in energy and low in fibre and the fourth group received a diet high in energy and in fibre.

Table 1 – Composition of the diets (% as fed)

	1	2	3	4
Energy	Low	Low	High	High
Fibre	Low	High	Low	High
Wheat bran	30	2	30	2
Molasses	5	5	5	5
Beet pulp	2.6	17	3.1	17.5
Soya bean meal	8.2	0	10.6	2.4
Sunflower meal	0	30	5.5	34.2
Sunflower seeds	0	0	1.5	1.5
Pea	5.8	2.0	4.2	2.0
Alfalfa meal	30	16	24.2	10.2
Vegetable oil	0	0.2	0	0.2
Wheat	0	14.3	2.7	17.0
Barley	2	0	2	0
Wheat straw	8.6	0	8.6	0
Rapeseed pulp	5.1	11.0	0	6.0
Vitamin and Mineral mix	2.7	2.5	2.4	2.2

Table 2 – Nutritive values of the diets (calculated, % as fed)

	1	2	3	4
Energy	Low	Low	High	High
Fibre	Low	High	Low	High
Dry matter	88.5	88.8	88.2	88.5
Crude protein	15.8	16.1	17.1	17.3
Fat	2.2	2.5	2.5	2.8
Ash	8.8	8.2	8.3	7.4
Starch	14.0	14.0	15.2	15.8
Crude Fibre	15.8	18.0	14.8	16.8
NDF	33.7	35.3	31.6	32.7
ADF	21.0	23.5	18.7	20.9
DE (kcal/kg)	2350	2350	2550	2550

NDF : Neutral Detergent Fibre *ADF : Acid Detergent Fibre* *DE : Digestible Energy*

Veterinary treatment

There was no antibiotic, no growth factor and no coccidiostatic in the diets. Rabbits received in the water 0.5 ml/l of tiamulin from 46 to 52 days of age and gentamycin (transgram 1.2 g/l) from 46 to 50 days of age. This is the practical veterinary treatment in case of epizootic rabbit enterocolitis

Records and control

Rabbits were weighed by cage at weaning at the age of 35 days. Weights of animals were recorded at 49 and 72 days. Feed intake was recorded by cage at 49 and 72 days. Mortality and illness of rabbits were noted daily. Dressing percentage and body fat were measured at the slaughter house only by treatment without repetition. Body fat was measured using the INRA scale. Mean results for weight, average daily gain, feed intake, feed conversion index were calculated for each period (35-49 and 49-72 days) and for the total fattening period.

Statistical analysis

Analysis of variance was carried out on the results according to a factorial model : fibre, energy and their interaction, group of initial weight. The statistical analysis of treatment effect on mortality results was carried out with a Chi Square Test.

RESULTS AND DISCUSSION

Mortality and illness

The average mortality of the trial was 18.3 %, which is quite high. Mortality was mainly due to epizootic rabbit enterocolitis (36 %) and to diarrhoea (26 %). The number of ill rabbits was high too: 49 rabbits were in diarrhoea during the trial (but they did not die). The average percentage of morbidity (mortality plus illness) was 28.6 % in the trial.
There was no statistical difference between treatments at 72 days of age (Table 3) but the treatment 2 (low energy and high fibre) had the lowest mortality : 13.1 %. It was the treatment with the highest level of crude fibre (18 %). The link between level of fibre and digestive disorders had already been described (De Blas, 1999 ; Perez, 1996) through the effect on fermentations in the caecum. The decrease of fibre level leads to an increase of digestive disorders because of the decrease of volatile fatty acid concentration in the caecum (De Blas, 1999).

Table 3 – Causes of mortality and illness mortality and morbidity 35-72 days

Treatment	1	2	3	4	Total	X^2
Energy	low	Low	high	High		
Fibre	low	High	low	High		
Number of dead rabbits :						
- Diarrhoea	8	5	8	11	32	
- Pneunomia	0	1	1	0	2	
- Paresie	4	2	1	4	11	
- Epizootic rabbit enterocolitis/paresie	1	0	1	1	3	
- epizootic rabbit enterocolitis	9	10	14	11	44	
- unknown	9	4	10	8	31	
Mortality (total number)	31	22	35	35	123	

Mortality (as %)	18.5	13.1	20.8	20.8	18.3	NS
Number of ill rabbits						
- Diarrhoea	8	11	14	16	49	
- Others	4	4	6	6	20	
Morbidity (as %)	25.6	22.0	32.7	33.9	28.6	NS

As far as only the lighter rabbits were concerned, there was a tendency of less total mortality for the treatment 2 (low energy and high fibre) : 14.3 % against 32.7 % to 37.1 % for the others treatments (Table 4).

Table 4 – Mortality (%) by period for all the rabbits and for the 25 % lighter rabbits

Treatment	1	2	3	4	X^2
Energy	low	Low	high	high	
Fibre	low	High	low	high	
- 35-49 days	3.0	2.4	5.4	7.7	P=0.12
- 49-72 days	15.5	10.7	15.5	13.1	NS
- 35-72 days	18.5	13.1	20.8	20.8	NS
- 35-72 days (for the 25 % lighter rabbits)	37.1	14.3	32.7	34.3	P=0.12

The energy of the diet had a statistically significant effect on mortality during the first period of the trial and during the total period of the trial (Table 5) with 5 points of difference for mortality 35-72 days (15.8 % for low energy against 20.8 % for high energy). This could be linked with a reduction of caecal transit as far as feed intake is lower with high energy level.

Table 5 – Effect of energy on mortality (%) by period

Energy	Low	High	X^2
- 35-49 days	2.7	6.5	P=0.02
- 49-72 days	13.1	14.3	NS
- 35-72 days	15.8	20.8	P=0.12

Growth performance

Results are in presented in Table 6.

There was no interaction between fibre and energy levels in the statistical analysis. The energy effect on weight and daily gain was not significant but there was a fibre effect, with about 70 g more live weight at 49 days and at 72 days for the rabbits receiving the high fibre diets. This fibre effect (statistically significant) was mainly due to growth differences from 35 to 49 days of age : 42.8 g/day for low fibre diet against 47.3 g/day for high fibre diet (whatever the energy) ; in other words 4.5 g/day of growth difference from 35 to 49 days of age. This is in accordance with Pinheiro (1999) who observed a decrease of daily gain with the decrease of ADF diets in post-weaning period and had less effect of ADF on growth in the second period of fattening.
As far as consumption and feed index conversion are concerned, fibre was no more so significant but energy effect was the most important. For a difference of

200 kcal/kg, we observed a difference of about 6.6 % of consumption (P ≤0.001) for the total period, with less consumption for high energy diets (Table 6). From 35 to 49 days of age, fibre and energy contents had a statistical significant effect on feed intake with higher consumption for low energy diet and higher consumption for high fibre diet. So the difference between treatment 2 (low energy and high fibre) and treatment 3 (high energy and low fibre) was 140 g of feed intake from 35 to 49 days of age, or 8,4 %, which is quite high.
The effect of energy was statistically significant for feed conversion index whatever the period : on the total period (35-72 days), there was 6 % of difference between high and low energy, with lower feed conversion index for high energy diets (3.26 against 3.46 in average). Statistically, fibre effect was seen only on the first period (35 to 49 days of age) with 6,1 % of difference for feed conversion index in favour of high fibre diets : 2.46 against 2.62 for low fibre diets. The decrease of feed conversion index with high fibre level in post-weaning period was linked with a higher weight at 49 days and a higher feed intake from 35 to 49 days. This was observed by Carabaño (1988) ; with the increase of dietary level of fibre, the feed intake and the soft faeces production enhance. Then, the ingestion of protein (from soft faeces) increase and this allows higher weight.

Table 6 – Effect of energy and fibre on performance of fattening rabbit

Treatment	1	2	3	4	MSE	Energy	Fibre	Group of initial weight
Energy	low	low	high	high				
Fibre	low	high	low	high				
Weight (g)								
- 35 d	1075	1083	1077	1079	37	NS	NS	***
- 49 d	1681	1738	1669	1749	88	NS	***	***
- 72 d	2656	2705	2624	2718	140	NS	*	***
ADG (g/d)								
- 35-49 d	43.3	46.8	42.4	47.9	5.1	NS	***	***
- 49-72 d	42.4	42.0	41.5	42.1	5.1	NS	NS	P =0.07
- 35-72 d	42.7	43.8	41.8	44.3	3.3	NS	**	***
FI (g)								
- 35-49 d	1603	1661	1521	1591	142	*	*	***
- 49-72 d	3880	3950	3584	3664	310	***	NS	***
- 35-72 d	5483	5610	5105	5254	388	***	P =0.08	***
FCI								
- 35-49 d	2.65	2.54	2.59	2.38	0.18	**	***	*
- 49-72 d	4.00	4.11	3.79	3.82	0.37	**	NS	NS
- 35-72 d	3.47	3.46	3.30	3.21	0.19	***	NS	NS

ADG : Average Daily Gain *MSE : Mean Square Error*
FI : Feed Intake *FCI : Feed Conversion Index*
*P<0005 ** P <0.01 *** P <0.001

The decrease of fibre level leads to an increase of retention time and a reduction of soft faeces production because of reduction of bacterial fibrolitic activity (Gidenne, 1996 ; Gidenne, 1997 ; Gidenne, 1998 ; Perez, 1996). Then, that usually leads to an increase of digestibility of energy with the decrease of crude fibre in diet (Gidenne

1998, de Blas 1994, Ortiz 1989 which should decrease the feed conversion index. In our trial, there is a positive effect of high dietary fibre mainly on growth (probably through a positive effect of dietary fiber on caecal fermentations in case of epizootic rabbit enterocolitis) and on feed intake too (less significative) which reduced probably the difference of feed conversion index between high or low level of dietary fibre.

Table 7 – Effect of treatment on slaughter parameters

	1	2	3	4
Dressing percentage	58.1	57.6	59.3	59.2
Body fat	3+	3-	2.5	3

Dressing percentage and body fat are given by treatment in table 7. We observed higher dressing percentage for rabbits receiving high energy diet. This was observed by Gidenne (1999) too. This could be in relation with the weight of the digestive tract (not measured in our trial) which could be higher for the rabbits with higher feed intake.

As a conclusion, in case of epizootic rabbit enterocolitis, it is favourable for breeders to use a diet with high fibre content and low energy, with the aim of reducing mortality. Nevertheless, as far as feed conversion index and dressing percentage are concerned, it would be preferable to use diets with high level both for energy and fibre.

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