

EFFECT OF DIGESTIBLE FIBRE/STARCH RATIO AND ANIMAL FAT LEVEL IN DIETS AROUND WEANING ON MORTALITY RATE OF RABBITS

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ABSTRACT

Ten experimental diets were formulated according a factorial design with 5 digestible fibre/starch ratios (0.75-0.84, 1.07-1.17, 1.57-1.66, 2.47-2.50 or 4.59-4.27, by replacing mainly wheat with beet pulp) and 2 levels of animal fat (3% or 6%). Four hundred young rabbits were fed on each diet from 17 to 42-day old and then switched to a commercial feed until 63-day old. Mortality rate along the trial was very high (40.7%) and diet-dependent. The digestible fibre/starch ratio had an effect on mortality rate: it decreased (45.8%, 45.4%, 39.4%, 38.0% and 35.0%, $P < 0.001$) as digestible fibre/starch ratio increased; this effect originates in 4th to 6th week period, when differences in mortality rate were much important (36.4%, 29.3%, 24.8%, 19.0% and 13.6%, $P < 0.001$). Moreover, the level of animal fat seems not affect total mortality rate but its distribution in the two considered periods: in 4th to 6th week period mortality rate was greater with the high-fat diets (26.5% vs. 22.8%, $P < 0.01$), the opposite occurring in 7th to 9th week period (19.4% vs. 23.2%, $P < 0.05$). According these results, in order to reduce the mortality rate, it seems advisable the inclusion of digestible fibre instead starch and not a noteworthy increase of the animal fat content in diets for rabbits around weaning, but further research is necessary to develop adequate feeding programs to maintain the reduction on mortality during the rest of growing period.

Key words: digestible fibre, starch, fat, around weaning, mortality rate.

INTRODUCTION

Some reviews show rising attention on nutrition of rabbits around weaning, as well as on early weaning systems (GUTIÉRREZ, 2001; PASCUAL, 2001; GIDENNE and FORTUN-LAMOTHE, 2002). The carbohydrate fraction is very important in diets for young rabbits, mainly because of its effects on the digestive transit and on the substrate available for microbial activity in the hindgut, both factors affecting stability of its microbial ecosystem and gut health. Recently, GIDENNE (2003) have reviewed the role of dietary levels of low-digested fibre (ADF), digestible fibre (hemicelluloses + pectins) and starch in prevention of digestive troubles of growing rabbits. Thus, PEREZ *et al.* (2000) found positive effect

on post-weaning health status when replacing starch with digestible fibre in diets including similar ADF content. On the other hand, XICCATO *et al.* (2003) have assessed the influence of fat content in diets for early weaned rabbits.

In the current study, the influence of ten experimental diets formulated to wide variation in fibre digestible/starch ratio at two levels of animal fat and supplied around weaning (from 17 to 42-day old) on mortality rate is analysed.

MATERIAL AND METHODS

Diets

Ten experimental diets were formulated according a factorial design with 5 digestible fibre/starch ratios (by replacing mainly beet pulp with wheat) and 2 levels of animal fat. The ADF content was similar in all diets and, as well as the digestible fibre/ADF ratio, followed recent recommendations for weaning to 45-day old period (GIDENNE, 2003). The CP content was similar in all diets and the DE content varied scarcely among diets. Diets included a coccidiostatic (Robenidine, 66 ppm) but no antimicrobials were added in feed or water. Diets are described in Tables 1 and 2.

Table 1. Ingredients of experimental diets (% on DM basis).

	Diet									
	1	2	3	4	5	6	7	8	9	10
Wheat	28.00	21.00	14.00	7.00		24.00	18.00	12.00	6.00	
Beet pulp		7.00	14.00	21.00	28.00		6.00	12.00	18.00	24.00
Wheat bran		3.75	7.50	11.25	15.00		3.75	7.50	11.25	15.00
Soybean hulls	10.00	7.50	5.00	2.50		10.00	7.50	5.00	2.50	
Wheat straw	5.00	3.75	2.50	1.25		5.00	3.75	2.50	1.25	
Animal fat	3.00	3.00	3.00	3.00	3.00	6.00	6.00	6.00	6.00	6.00
Cane molasses						1.00	1.00	1.00	1.00	1.00
Basal mix ^A	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00

^A Alfalfa, 25; Sunflower meal, 20; Soybean meal, 6; Lysine, 0.3; Methionine, 0.1; Treonine, 0.1; Calcium hydrogen phosphate, 1.2; Calcium carbonate, 0.2; Sodium chloride, 0.5; Trace element/vitamin mixture (L-510, Ibérica de Nutrición Animal), 0.5

Animals

A total of four thousand 17-day old rabbits were randomly distributed in 400 litters of 10 animals and caged separately of the rabbit does but suckling once a day until weaning at 28-day old. Litters received one of the experimental diets from 17 to 42-day old and then were switched to a commercial feed until slaughtering at 63-day old. Feed and water were available *ad libitum*. Health status was daily controlled along the trial.

Statistical analyses

To assess if milk yield of rabbit does suckling each experimental group was homogeneous, litter size and weight at 17-day old (before distribution of young rabbits at random) was submitted to analysis of variance with digestible fibre/starch ratio and level of animal fat as main factors. Liveweight of young rabbits at 17-day old and at weaning was similarly analysed. Mortality rate (as referred to number of animals alive at the beginning of each considered period) was analysed by the X^2 test.

Table 2. Composition of experimental diets (MJ or g/kg DM).

	Diet									
	1	2	3	4	5	6	7	8	9	10
DE ^A	11.76	11.91	12.05	12.14	12.27	11.96	12.09	12.18	12.25	12.33
CP ^B	177	176	179	176	178	177	177	176	179	176
ADF ^B	218	218	219	219	217	219	217	216	216	219
Hemicelluloses ^B	120	127	135	148	157	110	118	133	142	150
Pectins ^C	31	44	58	71	84	31	42	53	64	76
DF ^D	151	171	193	219	241	141	160	186	206	226
Starch ^E	196	168	132	95	69	170	146	122	93	64
EE ^B	48	48	49	49	48	71	71	71	71	72
DF/ADF ratio	0.69	0.79	0.88	1.00	1.11	0.64	0.74	0.86	0.95	1.03
DF/starch ratio	0.77	1.02	1.47	2.30	3.50	0.83	1.10	1.53	2.23	3.53

^A by NIRS; ^B According EGRAN (2001); ^C According FEDNA (1999); ^D Digestible fibre (Hemicelluloses + Pectins); ^E According BLAS *et al.* (2000)

RESULTS AND DISCUSSION

Mean litter size and weight at 17-day old (before distribution of young rabbits at random) were 9.42 and 2719 g, averaging respectively from 9.30 to 9.50 and from 2695 g to 2735 g in rabbit does suckling the different experimental groups, with no significant differences linked to digestible fibre/starch ratio, level of animal fat or their interaction, that probably indicating similar milk availability until weaning for the different experimental groups, and consequently small influence of this trait on differences in both liveweight at weaning and pre- or post-weaning mortality rate. However, as observed in Table 3, liveweight at weaning was affected by diet, decreasing significantly as its digestible fibre/starch ratio increased.

Table 3. Liveweight in young rabbits fed on diets varying in digestible fibre/starch ratio (DF/S) and animal fat level (AF).

	DF/S						AF		P		
	Diets	Diets	Diets	Diets	Diets	Diets	Diets	RSD	DF/S	AF	DF/S
	1&6	2&7	3&8	4&9	5&10	1-5	6-10				* AF
17-day old	291	293	292	292	291	292	292	48	NS	NS	NS
Weaning	548 ^A	541 ^{AB}	537 ^B	528 ^C	518 ^D	532	536	91	***	NS	NS

NS, $P > 0.15$; ***, $P < 0.001$

^{A,B,C,D} Means with no superscripts in common differ with $P < 0.05$

In this trial, a very high mortality rate was observed (40.7%), as expected when no antimicrobials are used in rabbit farms suffering epizootic enterocolitis. In these conditions, PÉREZ DE ROZAS *et al.* (2003) indicate that mortality rate might reach 60-70%. Figure 1 illustrates the influence of experimental diets on mortality rate during the different considered periods.

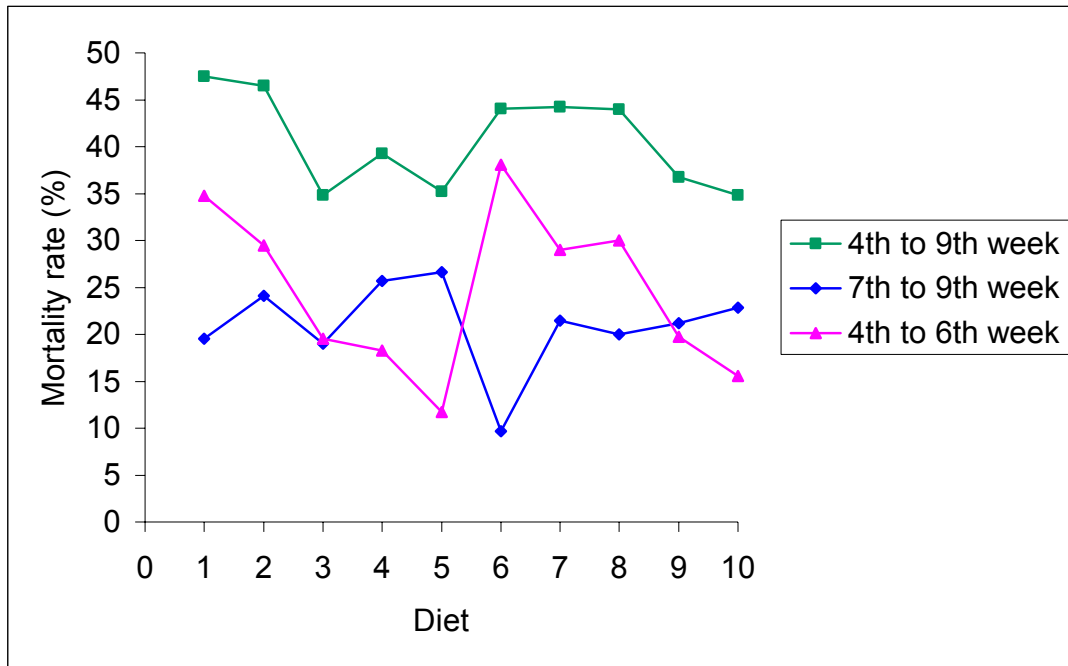


Figure 1. Mortality rate from 4th to 6th week (rabbits fed on the corresponding experimental diet), from 7th to 9th week (rabbits fed on a commercial feed) and from 4th to 9th week.

Mortality rate during pre- and post-weaning period (4th to 6th week) was clearly diet-dependent, decreasing significantly as digestible fibre/starch ratio increased and increasing with the higher level of animal fat (Table 4). Mortality rate after switching to a commercial feed, from 7th to 9th week of age, tended to moderate the differences linked to digestible fibre/starch ratio and cancelled the effect of level of animal fat.

Our results corroborate those obtained by PEREZ *et al.* (2000), in large scale trials carried out in rabbit farms with good health status; in 4 to 7-week old rabbits, these authors observed a progressive reduction of mortality rate from 6.7% to 2.4% as digestible fibre/starch ratio varied from 0.64 to 2.08 (149/233 to 249/120, on fresh matter basis). Concerning to fat level, XICCATO *et al.* (2003) showed that inclusion of vegetable fat (soybean oil and seed) in feed for early weaned rabbits (from 2.8 to 5.8% EE, on DM basis) did not affect health status of animals, though using lower number of animals and having much lower mortality rate (6.5% from 4th to 10th week) than in the current study.

Table 4. Mortality rate (%) in young rabbits fed on diets varying in digestible fibre/starch ratio (DF/S) and animal fat level (AF) from 4th to 6th week and on a commercial feed from 7th to 9th week.

	DF/S					AF		P	
	Diets 1&6	Diets 2&7	Diets 3&8	Diets 4&9	Diets 5&10	Diets 1-5	Diets 6-10	DF/S	AF
4 th to 6 th week	36.4 ^A	29.3 ^B	24.8 ^C	19.0 ^D	13.6 ^E	22.8 ^B	26.5 ^A	***	**
7 th to 9 th week	14.7 ^C	22.8 ^{AB}	19.5 ^B	23.5 ^{AB}	24.8 ^A	23.2 ^A	19.4 ^B	***	*
4 th to 9 th week	45.8 ^A	45.4 ^A	39.4 ^B	38.0 ^B	35.0 ^B	40.7	40.8	***	NS

NS, P>0.15; *, P<0.05, **, P<0.01, ***, P<0.001

^{A,B,C,D,E} Means within a factor with no superscripts in common differ with P<0.05

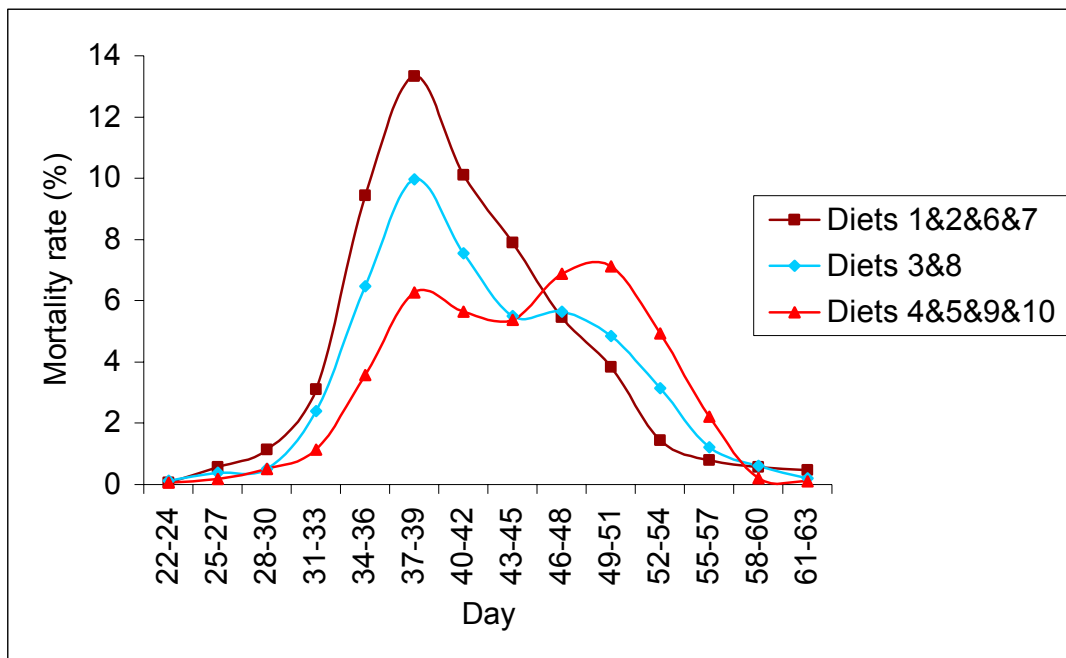


Figure 2. Mortality rate over 3-day periods in rabbits fed on low (1&2&6&7), intermediate (3&8) or high (4&5&9&10) digestible fibre/starch ratio diets from 4th to 6th week and on a commercial feed from 7th to 9th week.

More detailed evolution of mortality rate during the trial is presented in Figure 2. When examining mortality rate over 3-day periods in diets with high digestible fibre/starch ratio (4&5&9&10), as opposed to diets with low digestible fibre/starch ratio (1&2&6&7), a rise can be observed between 4rd and 9th day after switching to a commercial feed; this fact indicates probably greater impact on caecal microbial ecosystem when switching to a commercial diet lower in digestible fibre and higher in starch, because intense changes could be induced in the substrate for microbial activity. The evolution of mortality rate in intermediate diets (3&8) is in the middle of those observed in the other cases.

CONCLUSIONS

In order to reduce the mortality rate, it seems advisable the inclusion of digestible fibre instead starch and not a noteworthy increase of the animal fat content in diets for rabbits around weaning, but further research is necessary to develop adequate feeding programs to maintain the reduction on mortality during the rest of growing period.

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