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EFFECT OF SUPPLEMENTATION WITH ANIMAL PLASMA AND ANTIBIOTICS OF STARTER DIETS IN RABBITS

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ABSTRACT

Two feeding trials using 280 (individual-caged) and 420 (group-caged) and a digestibility trial using 66 early-weaned (25 d) rabbits, were conducted to evaluate inclusion of 2 or 4% of animal plasma (Appetein®) in substitution of soybean meal, and antibiotic supplementation (a mixture of 100 ppm of Bacitracine and 60 ppm of Apramicine) in six isonutritive starter diets. Type of diet did not affect DM or CP digestibility. Both animal plasma and antibiotic inclusion improved growth performance, but the response was more apparent at earlier ages (from 25 to 39 d of age) and when environment conditions were poorer. In these conditions, inclusion of a 4% of animal plasma or antibiotic supplementation increased ($P < 0.05$) feed intake and weight gain by around 8 and 7%, respectively, although feed efficiency was not affected. Antibiotic supplementation was effective (but not animal plasma addition) in reducing mortality caused by epizootic rabbit enteritis.

INTRODUCTION

Intensive production of rabbits in Spain is based at present on mating doe rabbits 11 days after parturition and weaning young rabbits at 35 d of age. As a consequence, reproductive rate is limited to a maximum of nine parturitions per year. Parturition interval might be decreased if earlier mating and weaning age were allowed by feeding a starter diet to young rabbits. Composition of such diet is limited by early digestive development. A major restraint for designing these diets is source of protein. Animal plasma has been successfully used in piglet diets to increase palatability and protein digestibility and to improve intestinal health (Allee and Touchette, 1999). The latter can also be improved by antibiotic supplementation. The aim of this study was to compare the use of animal plasma (Appetein®) in substitution of vegetable protein (soybean meal), and antibiotic supplementation in starter diets for early-weaned (25 d) rabbits.

MATERIALS AND METHODS

Diets

There were six experimental treatments. Treatments P1, P2 and P3 had 0, 2 and 4% of animal plasma added. Treatments P4, P5 and P6 were based in treatments P1, P2 and P3, respectively, adding 100 ppm of Bacitracine and 60 ppm of Apramicine. The different diets were formulated to meet or exceed all the essential nutrient requirements of growing rabbits (de Blas and Mateos, 1998). Their ingredient and chemical composition are shown in Tables 1 and 2, respectively. In order to formulate isonutritive diets, a mixture of soybean meal and soybean hulls was replaced by a mixture of animal plasma, barley, beet pulp and sepiolite.

Digestibility trial

A group of 66 New Zealand x Californian growing rabbits (11 per diet) of 25 d of age, weighing 515 ± 80 (SE) g, was assigned at random to the experimental diets to determine the apparent digestibility of dry matter and crude protein. No control of sex was done. Following a one week adaptation period, feed intake (ad libitum access) and total faecal output (caecotrophy was not prevented) were recorded for each rabbit over a four-days collection period (EGRAN, European reference method, 1995). During this trial, rabbits were housed in

Table 1. Ingredient composition of experimental diets, (%)

	Diets		
Ingredient (%)	**1 & 4**	**2 & 5**	**3 & 6**
Animal plasma	**0.0**	**2.0**	**4.0**
Wheat	16.4	16.4	16.4
Lard	2.5	2.5	2.5
Gluten 20	10.0	10.0	10.0
Wheat bran	20.0	20.0	20.0
Sunflower hulls	5.0	5.0	5.0
Lucerne hay	23.9	23.9	23.9
Soybean meal	8.9	4.4	0.0
Soybean hulls	10.0	8.9	7.7
Barley	0.00	0.23	0.47
Sugar-beet pulp	0.00	2.7	5.5
Sepiolite	1.7	2.2	2.8
Dicalcium phosphate	0.00	0.21	0.42
Calcium carbonate	0.27	0.18	0.10
Sodium chloride	0.50	0.50	0.50
L-Lysine HCl	0.064	0.032	0.000
DL-Methionine	0.114	0.109	0.104
L-Threonine	0.106	0.067	0.029
Vitamin/mineral premix	0.50	0.50	0.50
Robenidine premix	0.10	0.10	0.10

Table 2. Chemical composition of experimental diets (% DM)

	Diets		
Chemical analysis	**1 & 4**	**2 & 5**	**3 & 6**
Dry matter	91.3	90.8	91.5
Crude protein	17.2	17.3	16.9
Neutral detergent fibre	37.9	37.8	37.5
Acid detergent fibre	21.5	20.7	20.9
Acid detergent lignin	4.5	4.5	4.7

a building in which the temperature was partially controlled (average room temperature 19.2 ± 1.2º C). Animals were handled according to the principles for the care of animals in experimentation published by the Spanish Royal Decree 223/88. A cycle of 12 h of light and 12 h of dark was used throughout this trial.

Growth trial-UPM

Two hundred and eighty New Zealand x Californian weanling rabbits (25 d of age) were blocked by litter and assigned at random to the different dietary treatments. No control of sex was done. After weaning, rabbits were individually caged and had ad libitum access to the feed until they reached the slaughter age (60 d). The experimental diets were fed through a two weeks period after weaning. After that, all the animals were fed a commercial feed (CUNIUNIC®; NANTA, S.A.). Feed intake and weight of the rabbits at day 14 after weaning and at the end of the experimental period were recorded per cage.

Growth trial-COREN

Four hundred and twenty New Zealand x Californian weanling rabbits (25 days of age) were assigned at random to the different dietary treatments. No control of sex was done. After weaning, rabbits were caged in groups of seven and had ad libitum access to the feed until they reached the slaughter age (66 d). The experimental diets were fed through a two weeks period after weaning. After that, all the animals were fed a commercial fattening feed (CONEJOS N®, COREN S.C.L.). Feed intake and weight of the rabbits at days 14 after weaning and at the end of the experimental period were recorded per cage.

Analytical methods

Dry matter (DM) was determined on duplicate samples by heating at 103º C for 24 h. Acid detergent fibre (ADF), acid detergent lignin (ADL) and neutral detergent fibre (NDF) were determined according to the sequential procedure of Van Soest et al., 1991. Procedures of the Association of Official Analytical Chemists (1995) were used for ash and crude protein (N Kjeldhal and autoevaluation distillation unit Kilab nitrolab-auto: 954.01).

Statistical analysis

Data were analysed as a completely randomised block design with litter as block effect (UPM) or as a completely randomised design (COREN) with type of diet as the main source of variation. The General Linear Model (GLM) procedure of the Statistical Analysis Systems Institute Inc (SAS, 1990) was used. Weaning weight was used as a linear covariate in all the traits studied. Orthogonal contrasts were made for mean comparisons. Data are presented in tables as least-square means.

RESULTS

Digestibility trial

Inclusion of animal plasma decreased ($P = 0.02$) DM digestibility from 63.4 to 61.3%, but did not affect crude protein digestibility which averaged 77.7%. Addition of antibiotics did not affect either DM or crude protein digestibility.

Growth trial-UPM

Results of this trial are shown in Table 3. Inclusion of a 4% of animal plasma in the starter diet at the two-weeks after weaning period, increased linearly average daily gain (by 7.1%; $P = 0.05$) and feed intake (by 8.0%; $P = 0.01$). The effects were greater and more significant at the earlier ages. Supplementation with antibiotics also increased weight gain and feed intake at the 25-39 d period (by 6.4 and 7.7%; $P = 0.03$ and 0.004, respectively), but in this case the response was greater at the second rather than at the first week after weaning. Feed efficiency was not significantly affected by treatments ($P > 0.05$). The interaction animal plasma inclusion x antibiotic supplementation did not affect any of the traits studied. A compensatory growth effect was observed in the period 39-60 d, where all the animals received a commercial feed. As a consequence, no differences in average daily gain among treatments were found for the whole 25-60 d period. Antibiotic supplementation greatly reduced mortality both at the 25-39 and at the 25-60 d period (from 32.1 to 4.74 and from 44.8 to 12.8%, respectively; $P < 0.001$). No other significant effects were detected for this trait.

Growth trial-COREN

The results obtained are presented in Tables 4. No significant effect of treatments was found in this trial for any of the traits studied.

DISCUSSION

Taking into account that substitution of soybean meal with animal plasma was parallel to a decrease of soybean hulls and to an increase of barley and sugar beet pulp content in the diet, it can be deduced that crude protein digestibility of animal plasma was high (over 80%). The positive effects of animal plasma and antibiotics inclusion on growth and feed intake were more apparent at earlier ages, but disappeared at the latest growth period. The response to both factors also depended on the site of the trial, being significant at UPM but not at COREN. Health status of the animals was better in COREN than in UPM, as can be deduced from the lower average mortality, the higher weight gain for the control diet (diet 1) and the greater average feed efficiency. This was related to an outbreak of epizootic rabbit enterocolitis that affected UPM, but not COREN rabbitry. This is an infectious disease widely spread at present throughout Western Europe. Although the first episode of the disease in Spain was detected more than three years ago, there is still a lack of information about the ethiological agent (virus or bacteria) and currently no vaccine is available for control. The use of a complex of bacitracine and apramicine in UPM trial was effective in the control of the symptoms. However, animal plasma inclusion did not affect mortality rate.

CONCLUSIONS

From this study it can be concluded that animal plasma is a highly palatable and digestible source of protein for early-weaned rabbits. Based on our results, the positive response to animal plasma might depend on the age, the environmental conditions and the health status of the animals.

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Table 3. Effect of supplementation with animal plasma and antibiotics on growth performance and on mortality at different periods (UPM trial)

	Diets							Probability of contrasts[c]				
	1	**2**	**3**	**4**	**5**	**6**						
%animal plasma	0	2	4	0	2	4	SEM[a]	1	2	3	4	5
Antibiotics	NO	NO	NO	YES	YES	YES						
Period 25-39 d												
Weight gain, g/d	34.7	35.6	37.3	36.9	38.2	39.4	1.19	0.03	0.05	NS[b]	NS	NS
Feed intake, g/d	65.2	68.0	69.7	69.6	73.0	75.9	2.01	0.004	0.01	NS	NS	NS
Feed efficiency, g/g	0.531	0.524	0.531	0.529	0.523	0.528	0.009	NS	NS	NS	NS	NS
Period 39-60 d												
Weight gain, g/d	47.3	44.8	44.5	48.2	44.3	45.8	1.23	NS	0.05	NS	NS	NS
Feed intake, g/d	145.3	143.2	138.1	149.8	141.5	146.6	3.18	NS	NS	NS	NS	NS
Feed efficiency, g/g	0.327	0.313	0.329	0.320	0.306	0.319	0.009	NS	NS	NS	NS	NS
Overall Period (25-60 d)												
Weight gain, g/d	42.3	41.1	41.6	43.7	41.8	43.2	0.88	NS	NS	NS	NS	NS
Feed intake, g/d	113.3	113.1	110.7	117.7	114.1	118.3	2.28	0.03	NS	NS	NS	NS
Feed efficiency, g/g	0.374	0.364	0.379	0.369	0.363	0.371	0.007	NS	NS	NS	NS	NS
Mortality. n[d]	71	64	57	42	42	42						
Period, d												
25-39	36.6	28.1	31.6	2.38	4.76	7.14	5.35	0.0001	NS	NS	NS	NS
25-60	47.9	39.1	47.4	9.52	14.3	14.3	6.08	0.0001	NS	NS	NS	NS

[a] **n** = 35 as average // [b] **NS** = non significant (P > 0.05) // [c] **Contrast** 1=diets (1 +2 +3) vs (4 +5 +6); Contrast 2=diets (1 +4) vs (3 +6); Contrast 3=diets (1 +3 +4 +6)/*2* vs (2 +5); Contrast 4=diets (1 +6) vs (3 +4); Contrast 5=diets (**1** +**3** +*2 x* **5**) vs (**4** +**6** +*2* x **2**)
[d] **n** = initial number of animals in each diet

Table 4. Effect of supplementation with animal plasma and antibiotics on growth performance and on mortality (%) at different periods (COREN trial)

Trait		Diets							Probability of contrasts[c]				
		1	**2**	**3**	**4**	**5**	**6**						
Trait	%animal plasma	0	2	4	0	2	4	SEM[a]	1	2	3	4	5
	Antibiotics	NO	NO	NO	YES	YES	YES						
Period 25-39 d													
Weight gain, g/d		39.9	42.0	40.1	38.4	40.6	41.8	1.43	NS[b]	NS	NS	NS	NS
Feed intake, g/d		66.5	66.5	64.8	62.8	66.2	68.5	1.86	NS	NS	NS	NS	NS
Feed efficiency, g/g		0.601	0.631	0.615	0.606	0.610	0.610	0.013	NS	NS	NS	NS	NS
Period 39-66 d													
Weight gain, g/d		41.1	40.8	39.0	42.2	41.2	41.6	1.17	NS	NS	NS	NS	NS
Feed intake, g/d		142	143	141	143	139	142	3.28	NS	NS	NS	NS	NS
Feed efficiency, g/g		0.289	0.287	0.277	0.297	0.297	0.292	0.008	NS	NS	NS	NS	NS
Overall period (25-66 d)													
Weight gain, g/d		40.8	41.3	39.3	41.1	41.0	41.7	0.87	NS	NS	NS	NS	NS
Feed intake, g/d		117	117	115	116	114	117	2.44	NS	NS	NS	NS	NS
Feed efficiency, g/g		0.395	0.404	0.392	0.403	0.404	0.401	0.006	NS	NS	NS	NS	NS
Mortality by periods, d													
25-39		2.86	1.43	2.86	0	0	1.43	0.014	NS	NS	NS	NS	NS
39-66		7.86	7.14	12.1	2.86	5.72	8.57	0.034	NS	NS	NS	NS	NS
25-66		10.0	8.57	14.3	2.86	5.72	10.0	0.037	NS	NS	NS	NS	NS

[a] n = 10 groups of 7 animals
[b] NS = non significant (P > 0.05)
[c] Contrast 1=diets (1 +2 +3) vs (4 +5 +6); Contrast 2=diets (1 +4) vs (3 +6); Contrast 3=diets (1 +3 +4 +6)/*2* vs (2 +5); Contrast 4=diets (1 +6) vs (3 +4); Contrast 5=diets (**1** +**3** +*2 x* **5**) vs (**4** +**6** +*2* x **2)**