EFFECT OF DIFFERENT FEEDING SYSTEMS FOR YOUNG RABBIT DOES ON THEIR DEVELOPMENT AND PERFORMANCE UNTIL FIRST WEANING: PRELIMINARY RESULTS

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ABSTRACT

One hundred thirteen young rabbit does were used to study the effect of the feeding program during the rearing and first gestation on their development and performance until first weaning. Five experimental groups (CL, CR, FL, FC and FCF) were constituted from 9 weeks of age, following different feeding program during rearing and gestation period. Does of CL and CR groups received C diet (11.0 MJ DE, 114 g DP and 277 g ADF per kg of DM) offered always *ad libitum* in CL group and restricted (140 g/day) from 12 weeks of age to first parturition with *ad libitum* feeding during 5 days before insemination in CR group. Does of FL, FC and FCF groups received F diet (8.7 MJ DE, 88 g DP and 394 g ADF per kg of DM) *ad libitum* until 16 weeks of age; afterwards, FL group continued receiving F diet *ad libitum* until parturition while FC and FCF groups were switched to C diet also offered *ad libitum* until parturition in FC group and until 20 weeks of age in FCF group, that returned to F diet *ad libitum* from 20 weeks until parturition. After kindling, all groups were feed on C diet. Feed restriction affected ($P<0.05$) the live weight and body condition of young does at insemination (-326 g of live weight and -0.57 mm of perirenal fat thickness, CR vs. CL group) and at kindling (-171 g of live weight and -0.26 mm of perirenal fat thickness, CR vs. CL group), but performance of does was not affected. On the other hand, the use of a high fibre diet also induced lower live weight and body condition of does at insemination (-341 g of live weight and -0.44 mm of perirenal fat thickness, FL vs. CL group, $P<0.05$) in spite of their greater feed intake, but the use of C diet after 16 weeks of live (FC and FCF groups) allowed some recovery in live weight and body condition at insemination, as consequence of a higher energy intake (+149 kJ DE/kg $LW^{0.75}$ day, FC and FCF vs. FL group, $P<0.05$), and increased the size and weight of alive litter at birth in the FCF (returned to F diet *ad libitum* from 20 weeks of age until parturition). Feed intake during the first week of lactation was significantly different among groups ($P<0.05$), lower in CL group (78 g DM/kg $LW^{0.75}$ day), higher in FL and FCF groups (98 g DM/kg $LW^{0.75}$ day) and intermediate in CR and FC groups (87 g DM/kg $LW^{0.75}$ day), but no differences were found during the rest of lactation period. Milk yield was similar in all groups, but litter weight at weaning was lower in CR group.

Key words: Young rabbit doe, Feeding program, Development, Performance.

INTRODUCTION

Rabbit does have been successfully selected for prolificacy in recent decades (García and Baselga, 2002), and this improvement could have increased their nutritional requirements. Rabbit does are frequently lactating and gestating at the same time, these two functions are very costly in terms of energy and feed intake become the limiting factor in order to obtain enough nutrients, consequently a negative balance of energy occurs specially during lactation, that could affect body condition and reproductive performance of doe (Fernandez-Carmona *et al.*, 2000). Several works have tried to stimulate the voluntary feed intake throughout the use of fibrous diets until first parturition in young rabbit does (Nizza *et al.*, 1997; Xiccato *et al.*, 1999; Pascual *et al.*, 2002; Quevedo *et al.*, 2005; Szendrő *et al.*, 2006) showing in some cases improvement of the performance of does during their first

lactation. However, the feeding program could also affect the development of young does (if it is adopted too early) and performance at first parturition (number of kits born alive, survival index).

Therefore, the aim of the present work was to study the effect of the use of different feeding programmes based on a high fibrous diet or restricted intake during rearing and the first gestation on the development of young rabbit does and their performance until first weaning.

MATERIALS AND METHODS

Two experimental pelleted diets were used in this trial, which ingredients and chemical composition are summarised in Table 1. A conventional diet for rabbit does (C) was formulated according recommendation of De Blas and Mateos (1998) and a high fibre diet (F) was formulated with a digestible energy (DE) content lower than the standard value (9 MJ/kg DM) considered allowing a compensatory intake.

Table 1: Ingredients (g/kg DM) and chemical composition (g/kg DM) of the experimental diets (C=conventional diet for rabbit does, F=high fibre diet)

Ingredients	Diets		Chemical composition	Diets	
	C	F		C	F
Barley	312	78	Dry matter	898	900
Sunflower meal	94	51	Ash	90	103
Soya meal	85		Ether extract	52	29
Alfalfa hay	450	570	Crude protein	179	146
Beet pulp		152	Neutral detergent fibre	358	476
Straw		100	Acid detergent fibre	277	394
Soya oil	30	10	Acid detergent lignine	59	88
HCl L-lysine	2	3.9	Gross energy (MJ/kg DM)	18.2	18.7
DL-methionine		0.85	Digestible protein, DP[2]	114	88
L-threonine		1.45	Digestible energy, DE, (MJ/kg DM)[2]	11.0	8.7
L-triptophane	1	1.5	DP/DE (g/MJ)	10.3	10.1
Arginine		4			
Dicalcium phosphate	17	1.8			
Disodium phosphate		16.5			
Salt	5	5			
Vitamin and mineral premix[1]	4	4			

[1]Composition of vitamin and mineral premix (1 kg of feed contained): Vitamin A: 8375 UI; Vitamin D3: 750 UI; Vitamin E: 20 mg; Vitamin K_3: 1 mg; Vitamin B_1: 1 mg; Vitamin B_2: 2 mg; Vitamin B_6: 1 mg; Nicotinic acid: 20 mg; Choline chloride: 250 mg; Mg: 290 mg; Mn: 20 mg; Zn: 60 mg; I: 1.25 mg; Fe: 26 mg; Cu: 10 mg; Co: 0.7; BHA+Ethoxiquin: 4 mg
[2]Value determined by *in vivo* digestibility using 49 days old rabbits, according to Perez *et al*. (1995)

Chemical analyses of diets were performed following the methods of the AOAC (1995) for dry matter, ash, ether extract and crude protein, and according to Van Soest *et al*. (1991) for fibre fractions. Gross energy was determined by adiabatic bomb calorimetry (EGRAN, 2002).

A total of 113 young rabbit does were used. Until 9 weeks of age, all the animals received *ad libitum* the same commercial diet for fattening rabbits and, subsequently, does were housed in individual cages and assigned to one of the 5 experimental groups (CL, CR, FL, FC and FCF), following different feeding program during rearing and gestation period. Does of CL and CR groups received C diet, offered always *ad libitum* in CL group and restricted (140 g/day) from 12 weeks of age to first parturition with *ad libitum* feeding during 5 days before insemination in CR group. Does of FL, FC and FCF groups received F diet *ad libitum* until 16 weeks of age; afterwards, FL group continued receiving F diet *ad libitum* until parturition while FC and FCF groups were switched to C diet also offered *ad libitum* until parturition in FC group and until 20 weeks of age in FCF group, that return to F diet *ad libitum* from 20 weeks until parturition. After kindling, all groups were feed on C diet.

Does were artificially inseminated at 18 weeks of age and after 21 days if they failed to become pregnant, happening again the experimental protocol of each group around mating. Lactating does were artificially inseminated at 10 days *post-partum*. Litters were standardized at birth with 9 kits and

remained constant until weaning at 28 days post-partum by cross-fostering from five groups of nursing does following a protocol just like the experimental does.

The live weight and feed intake of does were controlled at 9, 12, 16 and 20 weeks of age, at kindling and weekly during lactation. The body condition of does was determined by measure of perirenal fat thickness using an ultrasound method (Pascual *et al.*, 2004) at 9, 12, 16 and 18 weeks of age, at kindling, at 10 days *post-partum* and at weaning. Daily milk yield was measured by weighing of does before and after suckling every day during lactation. The traits recorded in litters were: total and alive litter size and weight at birth; and litter weight weekly during lactation and at weaning.

Data were analysed using the SAS System® Software (SAS, 2002). To analyse rearing and lactation traits a mixed model was used including the experimental group as a fixed effect, and live weight and perirenal fat thickness at the beginning of the rearing period as covariates. To analyse gestation and kindling traits a GLM model was used including the above mentioned covariates. To analyse data of suckling litters a mixed model was newly used but including as covariate the weight of litter standardized at birth.

RESULTS AND DISCUSSION

The age of effective insemination of each group were 130, 127, 128, 128 and 129 days of age for CL, CR, FL, FC and FCF groups, respectively, because a 13-16% of does become pregnant at second insemination. Table 2 shows the results obtained with each assayed feeding program. Feed restriction (CR vs. CL) affected the live weight and body condition along rearing and gestation and they were significantly lower until kindling, but reproduction performance of does was not affected.

Table 2: Effect of feeding program during rearing and first gestation on performance of primiparous rabbit does

	CL	CR	FL	FC	FCF	SEM	P value
Nº of does	19	24	24	23	23		
Insemination:							
Feed intake at 18 week: g DM/kg $LW^{0.75}$ day	72^{b}	62^{a}	90^{d}	85^{c}	84^{c}	2	0.001
kJ DE/kg $LW^{0.75}$ day	794^{b}	687^{a}	785^{b}	936^{c}	932^{c}	17	0.001
Live weight of does at 18 week age (g)	4120^{c}	3794^{a}	3779^{a}	3958^{b}	4001^{b}	38	0.001
Perirenal fat thickness at 18 week (mm)	7.44^{c}	6.87^{a}	7.00^{ab}	7.34^{bc}	7.37^{bc}	0.14	0.030
Gestation:							
Feed intake: g DM/kg $LW^{0.75}$ d	53^{a}	54^{ab}	75^{d}	58^{bc}	63^{c}	2	0.001
kJ DE/kg $LW^{0.75}$ d	563^{a}	586^{ab}	635^{c}	619^{bc}	583^{ab}	17	0.034
Live weight of does at parturition (g)	4127^{b}	3956^{a}	3955^{a}	4078^{ab}	4064^{ab}	53	0.034
Perirenal fat thickness at parturition (mm)	6.42^{b}	6.16^{a}	6.30^{ab}	6.17^{ab}	6.22^{ab}	0.09	0.049
Alive litter size at birth	5.78^{a}	6.65^{a}	6.52^{a}	6.78^{ab}	8.42^{b}	0.62	0.044
Alive litter weight at birth (g)	315^{a}	379^{ab}	396^{ab}	356^{a}	455^{b}	28	0.016
Lactation:							
Feed intake 1st week (g DM/kg $LW^{0.75}$ day)	77.6^{a}	86.9^{b}	96.4^{c}	87.3^{b}	100^{c}	3	0.028
Feed intake 2-4 weeks (g DM/kg $LW^{0.75}$ day)	98.3	102	102	99.7	103	3	0.418
Live weight of does at weaning (g)	4171^{b}	4033^{ab}	3983^{a}	4085^{ab}	4037^{ab}	52	0.014
Perirenal fat thickness at weaning (mm)	6.64^{ab}	6.71^{b}	6.65^{ab}	6.42^{a}	6.67^{b}	0.08	0.020
Milk yield (g/day)	178	175	176	178	182	5	0.220
Litter weight at weaning (g)	4199^{ab}	4108^{a}	4244^{ab}	4226^{ab}	4289^{b}	56	0.020

CL, CR, FL, FC and FCF: experimental feeding programs (see text). SEM: standard error of the mean.
^{a,b,c} Means within a row do not sharing any superscript are significantly different ($P<0.05$)

On the other hand, the use of a high fibre diet also induced a significantly lower growth and body condition of does during the rearing period (FL vs.CL), in spite of their greater feed intake, but the use of C diet after 16 weeks of life (FC and FCF groups) allowed some recovery in live weight and body condition at insemination (as consequence of a higher energy intake), and increased the size and

weight of alive litter at birth in the FCF (returned to F diet *ad libitum* from 20 weeks of age until parturition).

Feed intake during first week of lactation was lower in CL group, higher in FL and FCF groups and intermediate in CR and FC groups but no differences were found during the rest of lactation period.

No significant differences between groups were detected in milk yield, nevertheless CR does showed the numerically lowest milk production during all period (3 to 18 g/day) and litter weight at weaning was significantly lower in this group. Does of FC group showed a lower perirenal fat thickness at the end of lactation, than those of FCF group.

CONCLUSIONS

In conclusion, it appears from the first results of this trial that the use of a high fibre diet during rearing does not produce major delay of the development of young rabbit does if followed with a conventional diet after 16 weeks of age. To switch to the high fibre diet during the second half of gestation could increase the number and weight of kits born alive, but more work is necessary in order to confirm this tendency.

ACKNOWLEDGEMENTS

The present work was supported by a grant from the Spanish Minister of Education and Science (project AGL2006-07596).

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