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EFFECTS OF A DIETARY PROTEIN REDUCTION DURING WEANING ON THE PERFORMANCE OF DOES AND SUCKLING RABBITS

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Abstract: The effects of a reduction in the dietary crude protein (CP) level during the period when lactating does and suckling rabbits share the same feed (from 21 days to weaning at 35 days of age) were investigated for several performance traits. Two iso-energy diets were formulated to contain 18.4 or 16.1% CP and were each given to 55 multiparous rabbit does and their offspring during two consecutive lactation cycles. Type of diet did not affect either feed intake or performance of rabbit does (body weight, fertility, prolificacy, culling rate) and young rabbits (growth rate or mortality before weaning). Accordingly, at least in the short period examined (two reproductive cycles), protein requirements of rabbit does and young rabbits in the period from 21 to 35 days of lactation can be fulfilled using diets with lower levels of CP concentration than those used at present in standard lactation diets.

Key words: dietary protein, doe rabbits, suckling rabbits, performance.

INTRODUCTION

Protein requirements in diets for lactating rabbits have been established in the range of 11.7-12.5 g digestible protein per MJ of digestible energy (Santomá *et al*., 1989; Xiccato, 1996). Dietary concentrations below these values have been proven to impair fertility, milk production and young rabbit growth. However, the effects of this reduction might be less significant after 21 days of lactation, when milk production begins to decrease. In addition, young rabbits at this time start to eat the same diet as that fed to their mothers, and a reduction in protein intake might affect their growth performance but also improve their gut health (De Blas *et al.,* 1981; Haffar *et al.,* 1988; Dojana *et al*., 1998; Gutiérrez *et al*., 2003). Furthermore, reducing protein concentration also contributes to limiting the nitrogen excretion at rabbit farms.

The aim of the present investigation was to study the effect of a decrease in the dietary crude protein content level during the period from 21 to 35 days after parturition on performance of rabbit does and weanling rabbits.

MATERIAL AND METHODS

Diets

A basal diet (HP) containing 18.4% CP and 13.0 g digestible protein (DP) per MJ digestible energy (DE) was formulated according to the nutrient recommendations of De Blas and Mateos (1998). Another diet (LP) was formulated to reduce CP concentration to 16.1% and DP/DE ratio to 11.5 g/MJ

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by increasing alfalfa meal and decreasing sunflower and soybean meal, but maintaining the DE content of diet. The ingredient and chemical composition of the experimental diets is shown in Table 1. Neither feeds nor drinking water were medicated at any time during the trial.

Animals

One hundred and ten (55 per diet) multiparous New Zealand × Californian rabbit does were assigned at random to the experimental treatments. Rabbit performance was recorded in two consecutive lactating periods. Nest access was restricted to 30 minutes per day. Does were artificially inseminated 45 minutes after suckling on the 11th day of lactation and kits were weaned at 35 days of age. Ovulation was induced with 0.2 ml of GnRH. Non pregnant does were not inseminated until the following insemination cycle (42 days). Does received one of the experimental diets during the period from 21 to 35 days after each parturition. The rest of the time rabbit does were fed with a non medicated standard lactation diet, similar to the HP diet. Does were given *ad libitum* access to feed. Young rabbits had free access to maternal feed. Performance traits (fertility, prolificacy, litter weight at 21 days and at weaning, feed efficiency, young and rabbit doe mortality and numerical productivity)

Table 1: Ingredients and chemical composition of the high and low crude dietary protein experimental diets.

		HP	LP
Ingredients (%)	Alfalfa hay	24.0	31.0
	Sunflower meal 30% CP	13.0	8.0
	Soybean meal 44% CP	9.5	4.45
	Barley grain	20.4	21.7
	Wheat bran	23.2	24.5
	Wheat straw	6.0	6.3
	Soybean oil	2.5	2.5
	Monocalcium phosphate	0.4	0.4
	Sodium chloride	0.5	0.5
	HCl -lysine	0.0	0.15
	Premix[1]	0.5	0.5
Chemical analysis (%)	Dry matter	91.7	92.0
	Crude Protein	18.4	16.1
	NDF	33.7	34.2
	ADF	17.1	17.5
	ADL	4.0	4.3
	Starch	18.1	18.6
	Digestible Energy (DE, MJ/kg)[2]	10.3	10.2
	Digestible protein (DP)[2]	13.4	11.7
	DP/DE (g/MJ)	13.0	11.5
	Lysine[2]	0.805	0.768
	Methionine + Cystine[2]	0.593	0.540
	Threonine[2]	0.667	0.583

HP, LP: high and low crude dietary protein, respectively.
[1]Premix included 0.40% vitamin-mineral premix and 0.10% Robenidine (6.6%).
[2]Values estimated according to FEDNA (2003).

were recorded per cage throughout the two experimental periods. Feed consumption and weight of does were recorded between parturitions and during lactation.

Housing

Animals were housed in polyvalent wired flat-deck cages measuring 1000 long × 380 wide × 290 mm high in one of the rooms of the Collective Fattening Rabbit Unit at the Poultry and Rabbit Research Center facilities. Building heating systems and forced ventilation allowed the temperature to be maintained at 21±2º C in the two experiments. Rabbit does were kept under 16 h of light and 8 h of darkness. Animals were handled according to the principles for the care of animals in experimentation published by the Spanish Royal Decree 223/88 (1988), and following the recommendations for applied nutrition experiments in rabbits of the European Group on Rabbit Nutrition (Fernández-Carmona *et al.*, 2005).

Analytical Methods

Chemical analysis of diets was performed using the procedure of Van Soest *et al*. (1991) for neutral detergent fibre, acid detergent fibre and acid detergent lignin. Methods of the AOAC (2000) were used for dry matter, crude protein and starch determinations.

Statistical Analysis

Data were analysed in a completely randomised design with type of diet as the main source of variation by using the General Linear Model (GLM) procedure of SAS (1990). The cage was considered as the experimental unit (n=55 per treatment). Repeated measurement procedure (SAS, 1990) was used to analyze the interaction between type of diet and reproductive cycle.

RESULTS AND DISCUSSION

The effects of crude dietary protein concentration on several productive traits of rabbit does and young rabbits are shown in Table 2. No interaction was found between type of diet and reproductive

Table 2: Effect of crude dietary protein level in the period from 21 to 35 days after parturition on rabbit does and suckling rabbits' performance.

	Diets		SEM[1]	*P*
	HP	LP		
Average doe weight at the start of the trial (g)	4682	4679	53	NS[2]
Average doe weight at the end of the trial (g)	4563	4601	58	NS
Fertility (%)	90.2	89.4	4.3	NS
Litter size at birth	9.66	9.60	0.17	NS
Litter size at 21 days	8.40	8.49	0.14	NS
Litter size at weaning	8.34	8.45	0.14	NS
Young rabbit weight at 21 days (g)	316	312	5	NS
Young rabbit weight at 35 days (g)	815	802	11	NS
Young rabbit mortality from 21 to 35 days (%)	0.75	0.42	0.59	NS
Feed intake of does+kits from 21 to 35 days (g/d)	593	576	9	NS
Culling rate (%)	0	0	0	NS

[1]SEM = Standard error of means (n =55). [2]NS = non significant ($P > 0.15$).

cycle. As a consequence, the statistical analysis was made on the average values obtained per trait in both periods.

The decrease from 18.4 to 16.1% in the CP concentration (13.0 to 11.5 g/MJ in the DP/DE ratio) of lactating diets did not significantly impair ($P > 0.15$) rabbit doe body weight, fertility, prolificacy, culling rate or feed intake by rabbit does and young rabbits when this reduction was made after the 21st day of lactation (Table 2). Neither had the treatment any effect on young rabbit growth rate or survival rate until weaning.

The results of this study indicate that the protein requirements of rabbit does might decrease in the period starting at 21 days after parturition up to a level of 11.5 g DP/MJ DE, which is in the lower range of recommendations made by Xiccato (1996) or De Blas and Mateos (1998) for highly productive rabbits. Previous works (Lebas, 1968; Torres *et al.,* 1979; Taboada *et al*, 1994) showed that daily milk production decreased after 21 days of lactation to a level around 70-75% of the average value measured in the first three weeks of lactation. Our results also suggest that protein concentration included in standard diets for rabbit does might be in excess of the requirements of young rabbits before weaning. Rabbit milk has a high protein concentration (38% DM, De Blas *et al*., 1995), so that, from the average feed and milk intake by young rabbits in this period, it can be deduced that high-quality milk protein still contributes around one third of the total crude protein intake in the period from 21 days of lactation to weaning at 35 days. The survival rate of suckling rabbits from 21 to 35 days of age was very high in the control diet (99.3%) and no effect of the diet was found on this trait. Accordingly, the hypothetical reduction of mortality in young rabbits due to a decrease in protein intake could not be demonstrated in our study.

From the results of this study it can be concluded that the protein concentration in diets for rabbit does and young rabbits after day-21 of lactation can be reduced, at least through two consecutive reproductive cycles, up to levels of 11.5 g DP/MJ DE, without any impairment of the performance of highly productive rabbits. However, the long-term effects (more than two reproductive cycles) of dietary protein reduction still have to be investigated.

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