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EFFECT OF DIETARY PROTEIN LEVEL ON MILK PRODUCTION OF ALGERIAN LOCAL RABBIT DOES

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ABSTRACT

Fifty-two Algerian local rabbit does were used to study the effect of dietary protein content during two reproductive cycles on milk yield and lactation curves. Three experimental groups were constituted by 17/18 does that received different isoenergetic diets with 2600 kcal Digestible Energy (DE)/kg during reproduction (gestation and lactation). Diets differed in their protein (CP) content (15%, 17%, and 19% for diets L (light), M (medium) and H (high), respectively) and were fed *ad libitum*.
The use of high protein diets did not affect rabbits does weight at parturition, daily feed intake and total litter size at birth (P>0.05). In contrast, the daily protein intake was significantly higher in rabbits fed H diet (P<0.001), regardless of parity. In addition, total milk production does not vary according to the dietary protein level (P>0.05). However, lactation peak occurs at different times (16^{th}, 20^{th} and 20^{th} day *PP* at first lactation and 15^{th}, 17^{th} and 20^{th} days *PP* at second lactation for L, M and H groups respectively), without significant effect of parity. In our experimental conditions, the change in protein level had no effect on milk yield but with increasing CP, lactation peak tended to occur later.

Key words: Rabbit doe, Diet, Protein, Lactation peak, Production.

INTRODUCTION

In the breeding rabbit does, the intake of digestible proteins is dedicated either for its body growth, for milk production or for fetal growth. When the does were simultaneously pregnant and lactating, the negative balance could appear especially if the intakes do not meet the requirements.

Maternal milk was the exclusive feed of the pups during their first days of life. This milk must be of good quality and enough for young rabbits. For this, the feeding of their mothers has to meet all these needs.

In growing rabbits, Ouhayoun and Dalmas (1983) have already showed a significant increase in slaughter age weight and overall growth rate with increasing feed protein. However, in the rabbit does, energy and protein requirements become necessary for the development of uterus and the fetus at pregnancy (Arias-Alvarez *et al*., 2009) and milk production. Several studies have reported the significant effect of energy/protein balance in rabbit does production (Xiccato *et al*., 1999) with decreasing feed intake when high energy diet ingested (Saidj *et al*., 2016)
Recent works were contributed to study the effect of protein diet on the first pregnancy (Saidj *et al*., 2019). Therefore, the aim of the present work was to study the influence of dietary protein content on live weight, feed intake and milk production of local rabbit does during the two first lactations.

MATERIALS AND METHODS

Animals and experimental design

Females used in the experiment, aged 4.5 to 5 months, were of Algerian local breeds characterized by a diversification of the color of the dress and weight. Fifty-two does were individually weighed and subsequently were kept in individual cages disposed to Flat-Deck system. They were divided into three

homogenous groups of 17/18 does each, and assigned to one of the 3 experimental groups (L, M and H), following different feeding program during first and second lactations. Mating was performed at 10 days *post-partum* for all does and weaning of litters were at 35 days. The live weight of does and feed intake were controlled weekly during lactations. Litters were enumerated at birth and weekly after partum. Weekly does weight and feed intake were recorded. Milk production of the two first lactations was controlled from parturition to 21d *post-partum*. Milk yield was measured every two days (on alternate days) by differential weighing of does immediately before and after suckling according to Parigi-Bini *et al.* (1992).

Experimental Diets

Three experimental pelleted diets increasing their protein content were used with 2600kcal Digestible Energy (DE)/kg during reproduction (gestation and lactation). Diets differed in their protein content: 15%, 17% and 19% for diets L, M and H respectively. Their ingredients and chemical composition are summarized in Table 1. All groups received diets *ad libitum* from parturition until weaning of the two first lactations.

Table 1: Ingredients and calculated chemical composition of the experimental diets

	L (15%)	M (17%)	H (19%)
Ingredients (%)			
Maize, 9% CP	35.0	28.0	23.0
Alfalfa meal, 17% CP	44.1	43.5	43.6
Barley	4.4	6.3	5.6
Soybean meal 44% CP	11.7	17.1	22.5
Wheat bran	2.0	2.3	2.5
Dicalcium phosphate	1.8	1.8	1.8
Minerals and vitamins premix[1]	1.0	1.0	1.0
Calculated chemical composition			
Digestible energy (kcal/kg)	**2600**	**2600**	**2600**
Crude fibre (%)	13.9	13.9	14.0
Crude protein (%)	**15**	**17**	**19**
Methionine - Cystine (%)	0.49	0.54	0.59
Lysine (%)	0.73	0.87	1.0
Calcium (%)	1.48	1.48	1.50
Total phosphorus (%)	0.59	0.61	0,63

[1]Premix provided : vitamin B6: 100 mg; Folic Acid:200mg, vitamin D1 : 200mg ; biotin :4mg ; choline chloride :18mg ; Co :40 mg ; Fe : 4000 mg ; Cu: 1000 mg ; Mn: 2000 mg; I: 80 mg; Zn: 6000 mg; Se: 8 mg; Mg:26000mg; S: 6800mg; methionine:8000mg; lysine: 30000mg.

Statistical Analysis

A mixed model was used to test several effects on live weight, feed intake and milk yield of rabbit does. The fixed effects were diet, parity and total alive litter size (used as covariate) while rabbit ID number was included in the model as a random effect repeated measurement. The data were analyzed using the mixed procedure for repeated measurements of SAS software (SAS, 2001) to identify significant sources of variation. The least-squares means were compared using ANOVA. The pups'number was analyzed using a non-parametric procedure (Kruskal-Wallis tests) and expressed as means.

RESULTS AND DISCUSSION

The dietary protein level and parity order don't affect the milk yield of local rabbit does (P>0.05). the effect of parity on milk production was not significant (P> 0.05), although the amount produced in second lactation was 5.4% higher (P> 0.05). In addition, the interaction diet x parity was not significant (P> 0.05) (Table 2). Contrary to our results, in rabbits fed with diets containing different protein levels (13.5%, 17.5% and 21% CP on DM basis), Partridge and Allan (1982) recorded an increase in milk production with increasing the protein content of the feed, without any change in the chemical composition of the milk.

Over the followed period, the results showed that there was no effect of the protein content of the diet on the daily feed intake of females (P> 0.05). However, the daily protein intake increased significantly with

increasing protein levels in diet (P <0.001; Table 2). Moreover, parity had no significant effect on the feed intake of does (P> 0.05). Females ingested as much in the first lactation as in the second. According to Rommers *et al.* (2004), the difference in the feed intake of rabbits was linked to the individual ingestion capacity which depends on the size and body weight of the animal.

Table 2: Effect of dietary protein level on productive performance and milk production of local does during the two first lactations (LSM±SE)

	Diet (D)			Parity (P)		P-value			
	L (15%)	M (17%)	H (19%)	P1	P2	D	P	DxP	Cov.
Rabbit does number	17	18	17	50	46	-	-	-	-
Live weight at parturition[A]	3776±76.7	3858±74	3742±76.4	3640±62.6	3945±66.3	0.53	0.002	0.73	0.06
Total litter size at birth	6.74±0.48	6.91±0.29	7.00±0.44	6.02±0.26	7.83±0.35	0.89	<0.001	-	-
Daily feed intake [D]	295±10.7	288±9.6	297±10.3	298±8.7	290±8.7	0.77	0.58	0.35	<0.0001
Daily protein intake [D]	44.5±1.92[a]	50.7±1.85[ab]	54.8±1.73[b]	50.4±1.57	49.5±1.56	<0.001	0.70	0.37	<0.0001
Milk yield at 1st week PP [B]	703±33.7	739±31.4	742±32.6	670±28	756±27.6	0.66	0.17	0.94	<0.0001
Milk yield at 2nd week PP[C]	1083±46.5	1086±42.4	1063±44.2	1062±38.3	1092±37.2	0.92	0.59	0.73	<0.0001
Milk yield at 3rd week PP[D]	1218±49.9	1300±45.5	1266±47.4	1242±4	1281±38.8	0.48	0.51	0.93	<0.0001
Total milk yield [D]	3016±122.5	3132±111.7	3080±116.4	3007±100.8	3145±97.8	0.78	0.35	0.68	<0.0001

Cov.: covariate. P: parity; D: diet. a,b,c, means with different letters on the same row differ significantly (P<0.05). [A] Covariate: Total litter size at partum. [B] Covariate: Total alive litter size at 1st week.[C] Covariate: : Total alive litter size at 2nd week.[D] Covariate: Total alive litter size at 3rd week.

The effect of parity on milk production was not significant (P > 0.05), although the amount produced in the second lactation was 5.4% higher. These results do not corroborate those found by Xiccato *et al.* (2004) who determined an increase in milk production of does during the 2nd and the 3rd lactation compared to the first one.

The effect of parity is highly significant on litter size (P<0.001) without any effect of diet. Our results are similar to those obtained by Brun and Lebas (1994) in crossbred rabbits does (2066 x 1077) with different protein contents (14.9% and 20.6% DM). However, in the long term, rabbits receiving the lower protein diet weaned a higher number of litters than females receiving the high dietary crude protein (Brun and Lebas, 1994).

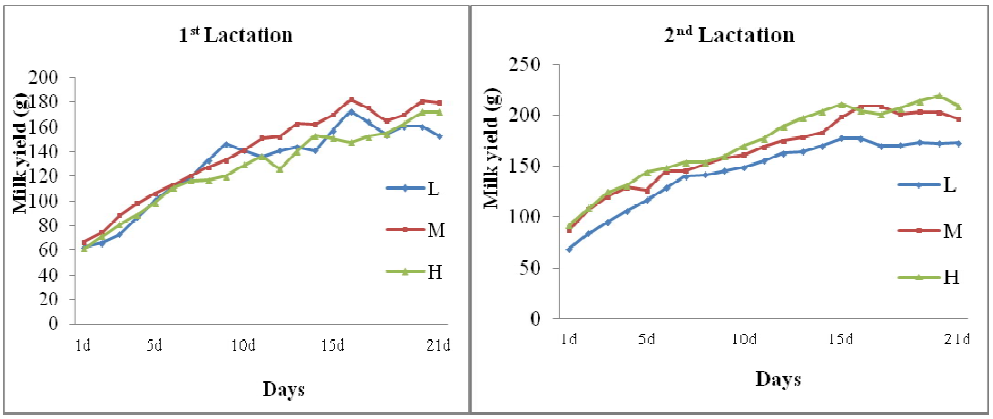

Figure 1: Effect of protein level on diet in milk production evolution at the first and second lactations

There was no significant difference among the average milk production of the different groups (Table 2), following similar curves in the two lactations (Figure 1). However, a difference in lactation peaks is noted depending on the feed intake and parity order. In 1st lactation, peaks are at 16, 20 and 20th day *PP* and in 2nd lactation, peaks are at 15, 17 and 20th day *PP* for groups L, M and H respectively. In the two lactations, the

early lactation peak was reached in females of L group and the later one in females of H group. Lebas (1968) and Fortun-Lamothe and Sabater (2003) recorded lactation peaks between 18 and 19 days *post partum*. However, in case of amino acid deficiencies in the diet, or when primiparous rabbits are subjected to an intensive reproductive rhythm, lactation peak is reached 2-3 days earlier (De Blas *et al.,* 1995; Taboada *et al.,* 1994), which is in agreement with the peak obtained in our experiment in rabbits fed the tow dietary protein level, regardless of parity.

CONCLUSION

In our experimental conditions, the change in dietary protein content had no effect on rabbits does live weight, total litters size between parturition and weaning and their milk production in the two first lactations, but it had a positive effect on lactation peak. In contrast, with literature data, parity number (1^{st} vs. 2^{nd}) did not have an effect on milk production of our local Algerian does.

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