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A FEEDING PROGRAMME FOR YOUNG RABBIT DOES BASED ON LUCERNE

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ABSTRACT: A feeding programme for young rabbit does based on a high fibrous diet was evaluated in the present work, using 46 crossbred does of 70 days of age. Two diets, control (C) and a high fibre diet (F) formulated almost exclusively with lucerne (96%), were compared. Young does in F group received F diet *ad libitum* until first parturition, while does in C group received C diet *ad libitum* until 3 kg live weight and then were restricted to 150 g per day. As of parturition, C diet was offered *ad libitum* to both groups until the end of the experiment. Up to 3 kg live weight, does given C diet had higher DE (P<0.001) intake and greater daily weight gain (P<0.001) than those fed F diet. C does weighed 3 kg and had the first parturition earlier than F does (18 and 7.6 days, respectively). F does ingested more food (P<0.001) during lactation, produced more milk (P<0.01) and weaned heavier litters (P<0.01) than C does, but litter size at birth and the number of pups replaced during lactation was not affected by diet. Maintaining these two groups for two years with the same reproduction schedule, no significant differences were detected in parturition interval, litter size at birth and litter size and weaning between them, although the figures related to F group were in general slightly better.

Keywords: young reproductive does, high fibrous diets, feed intake, milk yield.

RÉSUMÉ: Une alimentation à base de luzerne pour les lapines futures reproductrices
Ce travail porte sur les performances de reproduction de 46 jeunes lapines croisées dont la moitié a reçu un aliment à forte teneur en fibres (96% de luzerne) à partir de l'âge de 70 jours. Les lapines du lot F ont reçu cet aliment riche en fibres *ad libitum* jusqu'à la première mise bas. Les lapines du lot témoin ont reçu un aliment classique C *ad libitum* jusqu'au poids vif de 3,0 kg , puis rationné à raison de 150 g par jours jusqu'à la première mise bas. A partir de la première mise bas et jusqu'à la fin de l'expérience, les lapines des 2 groupes ont reçu l'aliment C à volonté. Par rapport aux lapines du lot F, entre 70 jours et le poids de 3,0 kg, les lapines du lot C ont eu une ingestion d'énergie digestible et un gain de poids vif significativement supérieurs (P<0,001). Les lapines du lot C ont atteint le poids de 3,0 kg et ont mis bas respectivement 18 et 7,6 jours plus tôt que les lapines du lot F. Les lapines du lot F ont ingéré plus d'aliment (P<0,001) pendant la lactation, ont produit plus de lait (P<0,01) et ont sevré des lapereaux plus lourds (P<0,01) que les lapines témoin C. Par contre, la taille de la portée à la naissance et le nombre de lapereaux remplacés au cours de la lactation n'ont pas été affectés par le régime alimentaire appliqué aux lapines avant la première mise bas. L'étude de la production moyenne des 2 groupes de lapines maintenues avec la même conduite d'élevage pendant 2 années, n'a permis de détecter de différence significative entre les 2 groupes ni pour l'intervalle entre portées, ni pour la taille de la portée à la naissance ou au sevrage, malgré des valeurs légèrement en faveur du groupe F.

INTRODUCTION

The improvement in rabbit genetics achieved in recent decades has greatly changed the requirements of reproductive does. Rabbit does are selected by prolificacy (mean litter sizes of nine or ten pups being usual), and they are inseminated with semen from males selected by high growth rate (pups demanding higher milk production). Therefore, there are some productive situations (e.g. first lactation or heat stress conditions) where the voluntary food intake is insufficient to cover the requirements of lactating does with commercial diets (PARIGI-BINI *et al.*, 1991; FERNÁNDEZ-CARMONA *et al.*, 1996; PASCUAL *et al.*, 1998a), which show a clear energy deficit or a lower productivity.

In order to alleviate these deficits, the solution would be to increase the digestible energy (DE) intake of does, increasing the DE content of diets or the voluntary food intake. There are several works in the literature concerning the use of different high energy diets in primiparous rabbit does (XICCATO *et al.*, 1995; FORTUN-LAMOTHE and LEBAS, 1996; PASCUAL *et al.*, 1998b; 1999) or under high ambient temperature (FERNÁNDEZ-CARMONA *et al.*, 1996; 2000). However, there is a lack of information about the possibility of varying the food intake response.

Voluntary food intake of reproductive does could be improved through genetic selection, although hereditability of this character seems to be low, or through a suitable feeding programme for young does in order to stimulate appetite and intake during their first reproductive cycle, just as proposed by PARIGI-BINI and XICCATO (1993).

Future reproductive does usually receive a restricted amount of food (approx. 140 g/day) until first partum, in order to avoid excessive fattening, higher perinatal mortality, suppression of voluntary food intake in early lactation and lower live reproduction of does (PARTRIDGE *et al.*, 1986; MAERTENS, 1992), although *ad libitum* programmes allow the first mating to be brought forward 1 or 2 weeks. In fact, LEBAS (1975) showed that a restricted diet (150 g/day) increased milk production with no adverse effects on litter size. Voluntary food intake decreases appreciably for does fed *ad libitum* at the end of pregnancy and is higher for previously restricted animals at early lactation.

Another way to stimulate food intake could be the use until the first partum in young does of fibrous diets, which are known to increase the weight of the digestive tract or some of its compartments and/or contents in growing rabbits (GARCÍA *et al.*, 1995; LEBAS *et al.*, 1982; FERNÁNDEZ-CARMONA *et al.*, 1998). The results of this approach are contradictory, while NIZZA *et al.* (1997) found a significant improvement in several reproductive parameters, XICCATO *et al.* (1999) did not find any difference between groups fed on control diet and a diet with a greater level of fibre.

The aim of the present work was to study the effect of a feeding programme based on high fibrous diets for young rabbit does on some of their subsequent reproductive traits. The main difference compared with the previous works was the use of an all lucerne diet, comparing with a control diet restricted from 3 kg live-weight to the first partum.

MATERIAL AND METHODS

Diets

Two pelleted diets were manufactured with the ingredients and chemical composition summarised in Table 1. Starting from a control diet (C) similar to a commercial diet, a high fibre diet (F) was formulated almost exclusively with lucerne (96%), including some ingredients or nutrients to partially correct obvious deficiencies in energy, amino acids and minerals. Therefore, the contents in diet F of acid detergent fibre (ADF) and DE were 298 g and 8 MJ kg^{-1}DM respectively, lower than the standard value of 9 MJ kg^{-1}DM considered to allow a compensatory energy intake.

Apparent digestibility coefficients of diets were determined in 20 three-way crossbred New Zealand x Californian growing rabbits of 42 days of age, housed in metabolism cages and fed *ad libitum*. The adaptation period was 7 days and the faeces collection period was 5 days following the procedure of PÉREZ *et al.* (1995), but mixing the faeces for the analyses.

Chemical analyses of diets and faeces followed the method of the ASSOCIATION of OFFICIAL ANALYTICAL CHEMISTS (1995) for DM, ash, EE, CP and CF and VAN SOEST *et al.* (1991) for neutral-detergent fibre (NDF), acid-detergent fibre (ADF) and acid-detergent lignin (ADL) with a thermostable amylase pre-treatment. GE was measured using an adiabatic calorimetric bomb.

Animals

Forty-six crossbred does (Californian × New Zealand) of 70 days of age with 2 kg live weight were used. Until this moment, all does received the same commercial diet for growing rabbits, and subsequently, does were housed in individual cages and had access to one of the experimental diets. The F diet was always offered *ad libitum*, but C diet was offered *ad libitum* until 3 kg live weight and then restricted to about 150 g of pellets per day (mean, 136 g DM; 10.7, standard deviation) using a small container previously calibrated, in an attempt to achieve a similar weight at parturition in the groups while their age and live weight at insemination were not much different. Does were artificially inseminated at a live weight between 3.2-3.5 kg. Food intake and weight were recorded for the periods 70 days of age - 3kg liveweight-insemination, and weekly afterwards until the end of the first reproductive cycle.

At parturition all does (C and F groups) had free access to C diet, which was offered *ad libitum* until the end of the experiment. Litter size was standardised at partum and maintained at 8 pups during the first lactation, replacing daily dead pups by others of a similar age and weight provided from nurse does; all lactating does were inseminated the 4th day after parturition, tested for pregnancy by abdominal palpation the 16th day and non-pregnant does were inseminated again the 26th day. After this date, successive inseminations were carried out every 14 days, when necessary. The litters were weaned at an age of 28 days. This procedure was carried out in the following reproductive cycles for 2 years time, where only date of parturition, litter size at birth and litter size at weaning were controlled.

To prevent nursing, primiparous does were placed in a cage next to the nest box and suckling took place once a day (around 9:00 a.m.), measuring milk output using the weigh (doe) - suckle - weigh (doe) method. Evolution of the food intake and weight of does were recorded until the end of the first lactation. Suckling pups were allowed to eat the same diet as their mothers during the final week of lactation. Weight and food intake of litters were also controlled.

Table 1: Ingredients (g kg^{-1}) **and chemical composition** (g kg^{-1} DM) **of diets.**

	Diets	
	C	F
Ingredients		
Lucerne hay	480	960
Barley grain	350	-
Soybean meal (CP44)	120	-
Animal fat	20	10
Methionine	1	1.5
Lysine	-	1.5
Arginine	-	1
Monosodium phosphate	-	22
Calcium hydrogen phosphate	23	-
Sodium chloride	3	1
Magnesium sulphate	0.1	0.1
Robenidine	0.8	0.8
Vitamin/mineral mixture	2.1	2.1
Chemical composition		
Dry matter (DM; g kg^{-1})	911	915
Ash	106	150
Crude protein (CP)	178	160
Ether extract (EE)	47	35
Crude fibre (CF)	144	241
Neutral-detergent fibre (NDF)	406	444
Acid-detergent fibre (ADF)	166	298
Acid-detergent lignin (ADL)	42.1	97.7
Gross energy (GE; MJ kg^{-1} DM)	18.06	17.63
Digestible energy (DE; MJ kg^{-1} DM)	10.99	8.02
Digestible protein (DP)	123.1	96.8
DP/DE (g kJ^{-1})	11.20	12.07

[1] Contains (g kg^{-1}): thiamin, 0.25; riboflavin, 1.5; calcium pantothenate, 5; pyridoxine, 0.1; nicotinic acid, 12.5; retinol, 2; cholecalciferol, 0.1; α-tocopherol, 39; phytylmenaquinone, 0.5; cyanocobalamin 0.006; choline chloride, 100; $MgSO_4 \cdot H_2O$, 7.5; ZnO, 30; $FeSO_4 \cdot 7H_2O$, 20; $CuSO_4 \cdot 5H_2O$, 3; KI, 0.5; $CoCl_2 \cdot 6H_2O$, 0.2; Na_2SeO_3, 0.03; BHT, 24.

Statistical analysis

Performance and reproductive life data were analysed by variance analysis, using the general linear GLM procedure of SAS (STATISTICAL ANALYSIS SYSTEM INSTITUTE, 1996). However, although evolution of food intake, milk production and live weights were also analysed by variance analysis, a mixed procedure (PROC MIXED) was used, according to a repeated measures design that takes into account the variation between animals and covariation within them. Covariance structures of mixed procedure were objectively compared using the most severe criteria (Schwarz Bayesian criterion), as suggested by LITTELL *et al.* (1998). Data were analysed in two different periods, from 2 kg live weight to partum and from partum to weaning. The model included as fixed effects the diet (C and F) for the first period and the diet (C and F), remating interval (P and W; post-partum and around weaning, respectively) and interaction diet-remating interval for the second period. For the evolution of litter weight analyses, standardised weight at birth was used as a covariate. The number of pups replaced was analysed according to a non-parametric procedure (NPAR1WAY), and for mean separation a chi-square test was used. After the first reproductive cycle, data were analysed by a standard procedure of

RESULTS

Table 2 shows the effect of the feeding programme on the performance of young rabbit does from 2 kg live weight to first parturition. Does given C diet, although presenting slightly lower DM intake, showed higher DE ($P<0.001$) and DP ($P<0.05$) intake, and greater daily weight gain ($P<0.001$) than those fed on F diet. Consequently, young does in C group reached 3 kg live weight 18 days earlier than does belonging to F group. From this moment to first parturition, the group F, which was fed *ad libitum,* ingested more DM, DE and DP ($P<0.001$), reaching first parturition only 7.6 days later than those in C group (fed on a restricted regime). The evolution of liveweight and food intake according to the imposed regime may be observed in Figure 1.

The data in Table 3 show the effect of the feeding programme received until first parturition and the effect of the remating interval on the performance during the first lactation. No significant interaction

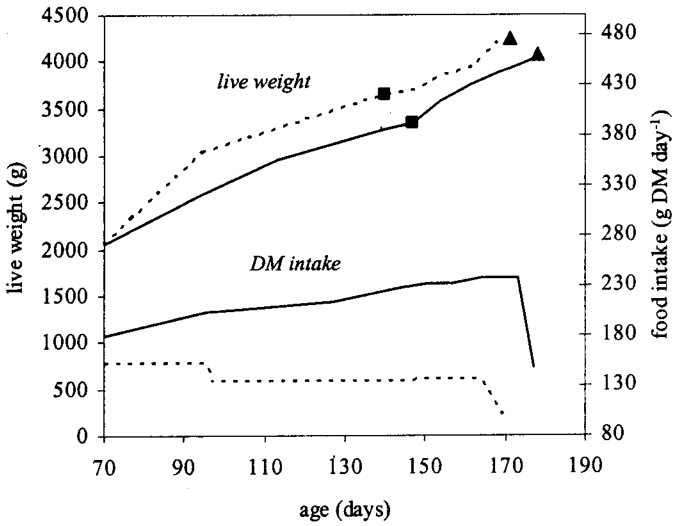

Figure 1: Evolution of live weight and DM intake in C (- - -) and F (—) groups, from 2 kg liveweight to partum (■ insemination, ▲ partum).

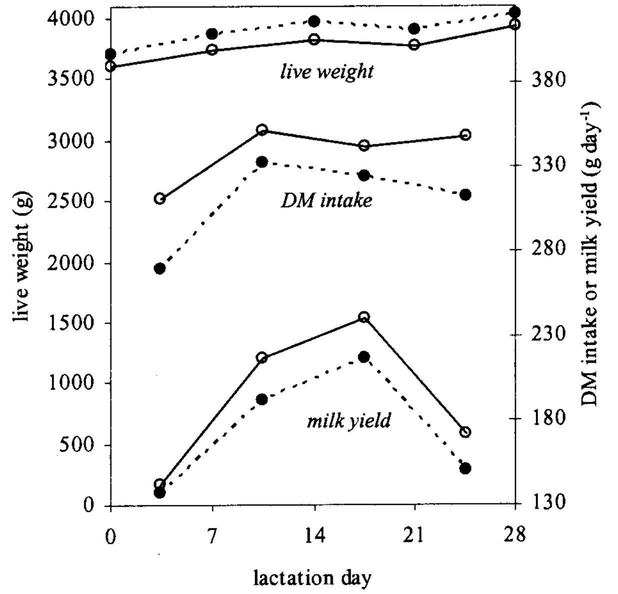

Figure 2: Evolution of live weight, DM intake and milk yield in C (- - - -) and F (—) groups during the first lactation.

between diet and remating interval was detected for any of the parameters analysed. Does coming from different feeding programmes presented similar live weight at partum (3648 g) and at weaning (3985 g). However, does receiving F diet until partum showed a significantly higher DM intake ($P<0.001$) throughout lactation (Figure 2), a higher milk production ($P<0.01$) and a greater weight of litters at weaning (+354 g; $P<0.01$). Feeding programme until parturition did not affect either the litter size at birth (8.6 pups) or the number of pups replaced during lactation (0.12 pups per litter).

Regarding the effect of the remating interval, higher DM intake and milk yield ($P<0.01$ and $P<0.05$, respectively) in lactation were found for does fecundated around weaning time (W group) than for those remated four days after partum (P group). Litter weight for this group was slightly higher, but significant differences were not found in any of the weeks.

The main long term effects of the feeding programme for young rabbits are summarised in Table 4. No significant differences were detected between does coming from C and F programmes, although the figures related to F group were in general slightly better: 4.3 more pups were weaned per doe and year ($P<0.1$) and 3 does more had 8 or more parturitions ($P<0.2$).

DISCUSSION

The trial was designed in line with an insemination weight of approximately 3.5 kg, which we currently consider as a minimum for our breed, so insemination took place at 19 and 20 weeks for C and F groups respectively. Does from F group should have had about 10 days more to achieve the same weight than does in C group, because they had lower weight at that time (3.36 and 3.66 kg for F and C groups, respectively), given that from 3 kg onwards a restrictive regime was imposed in group C. At the end, parturition of young does given F diet was only 7.6 days later than those on C diet. This different

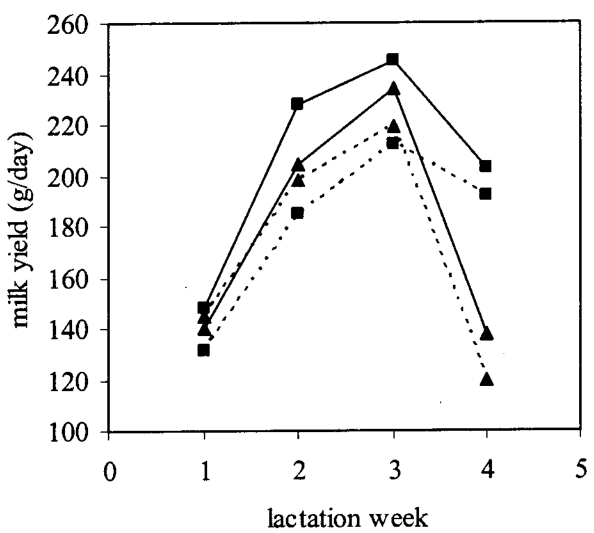

Figure 3: Evolution of milk yield in C (- - -) and F (—) groups, for post-partum (▲) and around weaning (■) remating intervals.

Table 2: Effect of the feeding programme for young rabbits on their performance from 2 kg live weight to first parturition.

	Feeding programme[1]			
	C	F	SE[2]	P-value
Live weight (LW) gain (g/day)				
Initial to 3 kg LW	41.15	22.21	1.22	0.0001
3 kg LW to first insemination	13.80	12.36	0.78	0.3590
first insemination to partum	17.74	21.31	1.13	0.1229
Duration of periods (days)				
Initial to 3 kg LW	25.38	43.18	1.85	0.0001
3 kg LW to first insemination	44.58	33.68	1.52	0.0001
first insemination to partum	32.92	33.64	0.78	0.6452
DM intake (g DM $kg^{-0.75}$ day^{-1})				
Initial to 3 kg LW	75.40	90.24	1.23	0.0001
3 kg LW to insemination	54.33	86.04	1.22	0.0001
gestation	46.34	80.75	1.78	0.0001
DE intake (MJ $kg^{-0.75}$ day^{-1})				
Initial to 3 kg LW	828.7	723.7	11.4	0.0001
3 kg LW to insemination	597.1	690.0	9.9	0.0001
gestation	509.3	647.6	15.2	0.0001
DP intake (g $kg^{-0.75}$ day^{-1})				
Initial to 3 kg LW	9.282	8.735	0.132	0.0470
3 kg LW to insemination	6.688	8.329	0.119	0.0001
gestation	5.705	7.817	0.181	0.0001

[1] C: group with diet C *ad libitum* until 3 kg liveweight and then restricted to 150 g fresh diet per day (22 animals) F: group with diet F *ad libitum* (24 animals)
[2] Standard error of the mean.

growth obtained with the two feeding programmes was mainly due to the fact that young does given F diet could not ingest a sufficient amount of food (physical limit) to compensate the diet's low DE during the first period. That lower live weight did not apparently affect the animal, but some strategy should be tried in order to have conditions closer to the farm practice, where some restriction in feeding the future reproductive does is recommended to postpone the first mating until about 18-19 weeks of age.

As expected, the use of diet F, which contained 298 g ADF kg^{-1} DM, was linked to a high dry matter intake (86 g DM $kg^{-0.75}$ day^{-1}) during the final growth period of future reproductive does. In fact, young does in F group partially recovered their live weight from 3 kg to parturition, showing a similar live weight at parturition than those in C group. XICCATO *et al.* (1999) also showed a similar response in feed intake when does were given a low energy diet, from 45 days of age until their first parturition; in this work, no reduction in growth rate was recorded, probably because the fibre and DE contents of diet (225 g ADF and 9.5 MJ per kg of DM) allowed the compensatory energy intake.

No difference was observed in the number and weight of litters at birth in groups C and F, in agreement with the results obtained by NIZZA *et al.* (1997) and XICCATO *et al.* (1999) using low energy diets for young does. However, slightly higher mortality at birth was registered for the litters of does in C group (11.6 and 2.7 % for C and F, respectively; P=0.07). Similar results were observed by XICCATO *et al.* (1999), which related the greater mortality at birth for litters fed on a commercial diet, to the higher fat content of does. PARTRIDGE *et al.* (1986) and PASCUAL *et al.* (1999) have observed that pup mortality at birth was higher for does receiving a high-energy diet during pregnancy than for animals fed on a low-energy diet. High individual weight at birth should increase the incidence of dystocia (PARTRIDGE *et al.*, 1985) or a build-up of fat in the abdominal cavity in the heaviest does, which could make foetal movement along the birth canal difficult (PARTRIDGE *et al.*, 1986).

The most relevant results related to the feeding scheme during growth, were a significantly higher feed intake and milk production for does that received F diet until parturition, and this was a specific effect of the diet. The possibility of a relationship between the restricted programme in pregnancy (150 g for does of group C with 3.66 kg live weight) and intake in the subsequent lactation seems to be low, although it cannot be discounted, when some works with a restriction programme starting at mating are examined. FORTUN-LAMOTHE (1998) estimated that a restriction of 150 g (3.8 kg live weight does) was not severe enough to induce a higher food intake after parturition, but LEBAS (1975) recorded a similar increase during the first week of lactation giving 140 g to does of 3.9 kg liveweight.

Table 3: Effect of the feeding programme for young rabbits and the remating interval on performance of does and litters during the first lactation.

	Feeding programme[1]			Remating interval[2]			
	C	F	P-value	P	W	P-value	SE[3]
No. of does	22	24		23	23		
Interval between parturitions (days)	49.85	49.29	0.840	35.33	63.80	0.001	1.34
Live weight of does (g):							
at partum	3686	3607	0.306	3656	3637	0.804	37
at weaning	4013	3954	0.445	4087	3880	0.010	38
Intake of does during lactation:							
g DM day^{-1}	311.9	339.5	0.007	318.1	333.3	0.125	4.7
g DM $kg^{-0.75}$ day^{-1}	112.9	125.0	0.001	115.1	122.7	0.010	1.4
kJ DE $kg^{-0.75}$ day^{-1}	1241	1374	0.001	1265	1349	0.010	15
g PD $kg^{-0.75}$ day^{-1}	13.90	15.39	0.001	14.17	15.11	0.010	0.17
Milk production of does (g/day)	173.1	193.2	0.010	173.2	193.2	0.010	3.6
Litter size at birth:							
total	9.60	8.72	0.188	9.05	9.27	0.747	0.32
alive	8.69	8.49	0.811	8.54	8.64	0.913	0.42
Litter weight (g):							
total at birth	542.1	496.8	0.133	527.4	512.5	0.595	14.4
alive at bith	498.8	481.3	0.698	503.0	477.1	0.564	21.7
standardised at birth	474.8	465.4	0.569	482.0	458.2	0.150	7.9
at 7th day of lactation[4]	1085	1140	0.190	1100	1125	0.544	20
at 14th day of lactation[4]	1841	2010	0.014	1899	1953	0.421	32
at 21st day of lactation[4]	2578	2794	0.052	2606	2766	0.156	52
at weaning[4]	4077	4431	0.009	4228	4292	0.647	65
Intake of litter during 4th week:							
g DM day^{-1}	127.3	133.1	0.665	138.3	122.2	0.234	6.5
g DM $kg^{-0.75}$ day^{-1}	50.89	51.23	0.942	54.29	47.83	0.175	2.30

[1] Until first parturition: C, group with diet C *ad libitum* until 3 kg liveweight and then restricted to 150 g fresh diet per day; F, group with diet F *ad libitum*.
[2] days between partum and following effective insemination.
[3] Standard error of the mean.
[4] litter weight standardised at birth included as covariate ($P<0.05$).

Expressed on a metabolic weight basis these intakes were 49 and 45 g DM per day in pregnancy, while ours was 46. Both authors, as well as COUDERT and LEBAS (1985), did not find any differences in litter size either at birth or at weaning, when a diet was given in pregnancy in a limited amount. Then in the present work the lactation performance of does in F group was compared with that of does in C group, which can be considered for the above reasons to be normal, not modified by the scheme followed in the trial.

As mentioned above, NIZZA *et al.* (1997) reported a significant improvement in litter weight and size at birth, litter weight at 21 days and feed intake in lactating does given a fibrous diet (283 g ADF kg^{-1} DM) before the first mating. In that work, the effect can be linked to a higher feed intake in lactation, considering the higher individual weight of rabbits that was found. In the present work, where the standardisation of litters during lactation completely removes the effect of litter size, it can be concluded that the difference between the several parameters was mainly due to the higher intake of does in F group.

The higher milk output found for group W should be a consequence of the higher dry matter intake found for these does, and has to be related to the pregnancy-lactation overlap. However, weight of litters in the subsequent weeks was similar, perhaps due to the fact that the difference in lactation performance traits observed for does in F group was mainly due to the higher feed intake (310 and 355 g DM day^{-1} for P and W does, respectively) and milk yield (129 and 197 g day^{-1} for P and W does, respectively) during the last week of lactation; in fact, no significant differences were found in the first three weeks of lactation. Furthermore, the higher, although

Table 4: Effect of the feeding programme for young rabbits on their mean results for two years.

	Feeding programme[1]			
	C	F	SE[2]	P-value
Life[3] (days)	538	568	36	0.685
Interval between parturitions (days)	52.86	50.19	1.56	0.397
Reproductive cycles (no.)	7.25	7.77	0.64	0.679
(no. year^{-1})	6.49	6.75	0.19	0.482
Pups alive at birth (no. year^{-1})	47.0	49.4	2.0	0.546
Pups weaned (no. year^{-1})	40.0	44.3	1.3	0.099

[1] Feeding programme until first parturition.
[2] Standard error of the mean.
[3] Interval between birth to elimination (reproductive problems, dead or end of trial).

non-significant, solid food intake found for litters from P does would compensate the lower milk intake, in terms of live body weight.

The exam of figure 3 suggests that the actual differences between does mated post-partum were not as high as could be assessed from figure 2, although F always presented better results than C group, and the trend is similar for both remating P and W groups. The fact that milk output is considerably lower in the third week of pregnancy, reported by several authors, is quite interesting. Such differences in response suggest that other factors, such as corporal condition, should be linked to those situations, affecting only feed intake, milk yield and remating interval of does. We could conclude that the evolution of corporal condition of does and its effect on the performance traits must be considered in future works. In this respect, female does in the work of NIZZA *et al.* (1997) were mated at about 14 days post-partum, a regime that we could define as intermediate of our two remating intervals, whereas does in the work of XICCATO *et al.* (1999) were not mated, but presented some differences between the groups at parturition and at weaning.

With respect to the results concerning the productive life of does, NIZZA *et al.* (1997) reported for does receiving a fibre diet until first mating, a higher number and individual weight of rabbits weaned, when an average of four reproductive cycles was examined. The results of the present work for F group certainly seem better than those registered for C group, but no final conclusions can be deduced from them. Actually, there are many factors present over a two-year period that can affect reproductive parameters, which are independent from the feeding programme used before the first parturition. Apart from that mentioned work, no other reference is available in the literature, but the subject itself may have sufficient interest to be reproduced.

In conclusion, the results of the present work suggest that the use of high fibre diets during the final growth period of future reproductive does could be an adequate feeding programme to increase the voluntary food intake of primiparous rabbit does, improving some performance traits significantly during the first lactation. Probably, fibrous diets must be introduced later than 2 kg live weight or for a shorter period, otherwise live weight or age at mating could be affected. More works have to be carried out in relation with the long term effect, which here showed a favourable tendency.

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Erratum

Table 1: Ingredients (g kg^{-1}) and chemical composition (g kg^{-1} DM) of diets.

	Diets	
	C	F
Ingredients		
Lucerne hay	480	960
Barley grain	350	-
Soybean meal (CP44)	120	-
Animal fat	20	10
Methionine	1	1.5
Lysine	-	1.5
Arginine	-	1
Monosodium phosphate	-	22
Calcium hydrogen phosphate	23	-
Sodium chloride	3	1
Magnesium sulphate	0.1	0.1
Robenidine	0.8	0.8
Vitamin/mineral mixture[1]	2.1	2.1
Chemical composition		
Dry matter (DM; g kg^{-1})	911	915
Ash	106	150
Crude protein (CP)	178	160
Ether extract (EE)	47	35
Crude fibre (CF)	144	241
Neutral-detergent fibre (NDF)	406	444
Acid-detergent fibre (ADF)	166	298
Acid-detergent lignin (ADL)	42.1	97.7
Gross energy (GE; MJ kg^{-1} DM)	18.06	17.63
Digestible energy (DE; MJ kg^{-1} DM)	10.99	8.02
Digestible protein (DP)	123.1	96.8
DP/DE (g kJ^{-1})	11.20	12.07

[1] Contains (g kg): thiamin, 0.25; riboflavin, 1.5; calcium pantothenate, 5; pyridoxine, 0.1; nicotinic acid, 12.5; retinol, 2; cholecalciferol, 0.1; α-tocopherol, 39; phytylmenaquinone, 0.5; cyanocobalamin 0.006; choline chloride, 100; $MgSO_4 \cdot H_2O$, 7.5; ZnO, 30; $FeSO_4 \cdot 7H_2O$, 20; $CuSO_4 \cdot 5H_2O$, 3; KI, 0.5; $CoCl_2 \cdot 6H_2O$, 0.2; Na_2SeO_3, 0.03; BHT, 24.

Statistical analysis

Performance and reproductive life data were analysed by variance analysis, using the general linear GLM procedure of SAS (STATISTICAL ANALYSIS SYSTEM INSTITUTE, 1996). However, although evolution of food intake, milk production and live weights were also analysed by variance analysis, a mixed procedure (PROC MIXED) was used, according to a repeated measures design that takes into account the variation between animals and covariation within them. Covariance structures of mixed procedure were objectively compared using the most severe criteria (Schwarz Bayesian criterion), as suggested by LITTELL *et al.* (1998). Data were analysed in two different periods, from 2 kg live weight to partum and from partum to weaning. The model included as fixed effects the diet (C and F) for the first period and the diet (C and F), remating interval (P and W; post-partum and around weaning, respectively) and interaction diet-remating interval for the second period. For the evolution of litter weight analyses, standardised weight at birth was used as a covariate. The number of pups replaced was analysed according to a non-parametric procedure (NPAR1WAY), and for mean separation a chi-square test was used. After the first reproductive cycle, data were analysed by a standard procedure of variance with diet as the fixed effect.

RESULTS

Table 2 shows the effect of the feeding programme on the performance of young rabbit does from 2 kg live weight to first parturition. Does given C diet, although presenting slightly lower DM intake, showed higher DE ($P<0.001$) and DP ($P<0.05$) intake, and greater daily weight gain ($P<0.001$) than those fed on F diet. Consequently, young does in C group reached 3 kg live weight 18 days earlier than does belonging to F group. From this moment to first parturition, the group F, which was fed *ad libitum,* ingested more DM, DE and DP ($P<0.001$), reaching first parturition only 7.6 days later than those in C group (fed on a restricted regime). The evolution of liveweight and food intake according to the imposed regime may be observed in Figure 1.

The data in Table 3 show the effect of the feeding programme received until first parturition and the effect of the remating interval on the performance during the first lactation. No significant interaction