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Nutritional effects on puberty and production performance of ewe lambs and goat kids

Ch. Papachristoforou, M. Hadjipanayiotou, A. Koumas, C. Christofides and S. Economides
Agricultural Research Institute, P.O. Box 2016, 1516 Nicosia, Cyprus

SUMMARY – Chios ewe lambs and Damascus goat kids born in autumn or spring were used to study nutritional effects during development on their performance. Within species and season of birth, the animals were allocated at random to 3 equal sized groups. Group A animals were put on a high, group B on a medium plane of nutrition and group C on a medium plus increased protein intake from 3 weeks prior to the start and until the end of mating. At monthly intervals, the animals were weighed and feed offered was adjusted accordingly. Following mating, all animals were housed and fed as a single group at slightly above maintenance plus a pregnancy allowance for the last 6 weeks prepartum. With the exception of the induced higher BW at mating, daily BW gain and daily concentrate and roughage intake until mating of animals in group A compared to those in B and C, there were no differences among treatments for litter size and 60 d milk yield in either autumn born or spring born lambs and kids. Similarly, there was no difference among treatments in the no. of animals pregnant and delivering. Based on the findings of the present study it may be concluded that there is no need for BW greater than 44 kg (around 65% of mature BW) at mating and of additional (>14% CP DM) protein 3 weeks prior to start and until the end of mating to attain higher productive and reproductive performance of lambs and kids.

Key words: Ewe lambs, goat kids, plane of nutrition, growth, milk performances, reproduction, puberty.

RESUME – *"Effets nutritionnels sur la puberté, et les performances de production des agnelles et des chevrettes". Des agnelles Chios et des chevrettes de race Damasquine nées en automne ou au printemps ont été utilisées pour étudier les facteurs nutritionnels pendant leur développement sur les performances ultérieures. Intra-espèce et intra-saison de naissance, les animaux sont répartis au hasard dans 3 lots de même taille. Le lot A est mis sur un programme alimentaire de niveau haut, le lot B sur un programme de niveau moyen et le lot C sur un niveau moyen avec une consommation accrue de protéines pendant 3 semaines du début à la fin de la lutte. Chaque mois, les animaux sont pesés et les quantités d'aliments distribuées sont ajustées. Après la lutte, les animaux sont élevés en bergerie ou en chèvrerie et sont nourris en groupe unique à un niveau alimentaire légèrement supérieur à l'entretien plus le besoin de gestation pendant les 6 dernières semaines avant la mise bas. A l'exception du poids induit plus élevé à la saillie, le gain de poids quotidien et les ingestions de fourrage et de concentré jusqu'à la saillie des animaux du lot A sont comparables à ceux des lots B et C ; il n'y a aucune différence due aux traitements sur le nombre d'animaux en gestation et ayant mis bas. A partir de ces résultats, on peut conclure qu'il n'y a aucune nécessité d'apports alimentaires pour obtenir un poids vif supérieur à 44 kg (environ 65% du poids adulte) à la saillie et aucun besoin d'apporter plus de protéines que 14% de la matière sèche pendant les 3 semaines du début à la fin des saillies pour obtenir des performances supérieures de reproduction et de production laitière des agnelles et des chevrettes.*

Mots-clés : *Agnelle, chevrette, programme alimentaire, reproduction, performances laitières, croissance, puberté.*

Introduction

One rationale for dairy producers offering higher planes of nutrition to have replacements reared to heavier live weights (LWTs) is the expectation that lifetime earnings from the animal would increase. Johnson and Bernal (1998) stated that the rearing of dairy replacements needs to consider the future dam, the foetus and the mammary gland. Studies (Little and Kay, 1979; Sejrsen *et al.*, 1982) have indicated that when prepubertal growth rates of heifers increase, time to conception, age at first calving and milk yield during first lactation decrease. Similar studies with dairy sheep and goats are limited. Preliminary studies carried out at our Institute (Papachristoforou, unpublished data) showed that the reproductive performance of Chios ewe lambs born in autumn and raised on a high level of nutrition from 3 months of age until mating was enhanced compared with ewe lambs raised on a medium nutritional level. The milk production of the animals was not affected. Norwegian studies (Havrevoll *et al.*, 1995) showed that goat kids on a low level of nutrition produced marginally more milk than those on a high level of feeding. In the same studies there was no difference in reproductive performance between groups in

the second and third years, but in the first year goat kids on the high level of feeding produced a smaller litter size. Studies with Sarda ewes (Molle *et al.*, 1995) showed that flushing with soybean meal resulted in higher ovulation rate than flushing with whole corn grain whereas milk yield was not affected by flushing.

Chios ewe lambs and Damascus goat kids born in autumn or in late winter/early spring are normally mated at the age of 12-13 or 7-8 months, respectively. Body weight (BW) at mating in commercial flocks ranges from 42 to 58 kg. Spring born lambs and kids are kept on a high plane of nutrition in order to reach 60% of mature BW at mating; the same applies also for autumn born lambs and kids that are mated at high BW. The present studies examined the effects of a high and medium levels of nutrition during development in Chios ewe lambs and Damascus goat kids born in autumn or in late winter/early spring on their reproductive development and performance. The effect of flushing with additional dietary protein shortly before and during mating on the performance of animals kept on the medium level of nutrition was also examined.

Materials and methods

Chios ewe lambs and Damascus goat kids born in autumn or in early spring were used to study nutritional effects during development on their performance. Seventy-two autumn born, 103 spring born Chios ewe lambs, 51 autumn born and 97 spring born Damascus kids were used in trials 1, 2, 3 and 4, respectively. The initial weight and age of the animals are in Tables 1 and 2. The study utilized animals from two government and a private (trial 2) farm. Within species and season of birth, animals were allocated at random in 3 equal sized groups. Group A animals were put on a high plane of nutrition, group B on a medium plane and group C on a medium plane plus increased protein intake from 3 weeks prior to the start and until the end of mating.

Table 1. Productive and reproductive performance of Chios ewe lambs on different levels of nutrition during development

	Autumn born				Spring born			
Treatment	A	B	C	SD	A	B	C	SD
Initial WT (kg)	33.7	33.4	34.0	3.95	29.6	30.4	30.3	4.83
Initial age (d)	123	123	123	8.0	106	107	106	13.2
Age at mating (d)	362	358	361	10.3	246	244	246	13.8
WT at start of mating (kg)	52.9	45.5	45.6	6.4	47.7	42.5	43.0	6.1
WT at end of mating (kg)	54.5	46.6	46.2	6.55	49.5	46.7	45.8	5.7
WT at lambing (kg)	66.3	59.2	59.6	6.98	NA††	NA	NA	–
Litter size	1.76	1.63	1.74	0.75	1.63	1.63	1.84	0.71
60-d† milk yield (kg)	137	119	113	39.3	184	180	176	45.8
Feed intake until the end of mating (g/h/d)								
Concentrate	760	615	606	–	1053	784	785	–
Hay	408	330	330	–	563	420	4200	–

†Postweaning period, feed intake (g/h/d) from the end of mating to 6 weeks prepartum: trial 1 conc. 840, hay 455, trial 2 conc. 827, hay 445; during the last 6 weeks of pregnancy: trial 1 conc. 900, barley hay 400, alfalfa hay 400; trial 2 conc. 900, oat hay 750 and alfalfa cubes 100.
††NA = not available.

The composition (%) of the concentrate mixture was 82.1 barley grain, 10.7 soybean meal, 5.0 wheat bran, 0.3 dicalcium phosphate, 1.3 limestone, 0.4 salt and 0.2 vitamin trace element mixture. In the concentrate used in group C from 3 weeks prior to the start and until the end of mating, 8% barley grain was replaced by soybean meal. The crude protein (CP) content (DM basis) of the two concentrate mixtures was 16 and 18%, respectively. During the first month of the experimental period, the animals

received a concentrate mixture of 18% CP and thereafter, a 16% CP mixture. Until the end of mating, animals of the 3 groups were placed in 3 adjacent pens and groups offered concentrate and roughage from separate troughs. Animals had free access to water. The animals were weighed at the beginning of the trial and at monthly intervals to allow for adjustments in the feeding regime if required, at the start and the end of mating and at delivering. Following mating, all animals were fed to gain 50 g BW daily plus a pregnancy allowance for the last 6 weeks prepartum (MAFF, 1975). The mating period lasted for 35 days. Lambs and kids were weighed at birth and at weaning. They were suckled continuously by their dams until weaned at 35 ± 3 or 49 ± 3 days of age in lambs and kids, respectively. A maximum of two young per dam were suckled and excess lambs and kids were reared artificially. Analysis of variance was made on the data using a general linear model.

Table 2. Productive and reproductive performance of Damascus goat kids on different levels of nutrition during development

	Autumn born				Spring born			
Treatment	A	B	C	SD	A	B	C	SD
Initial WT (kg)	24.5	24.6	24.2	2.96	35.8	35.1	34.5	4.11
Initial age (d)	129	129	129	3.1	159	158	158	5.1
Age at mating (d)	307	306	307	5.2	257	254	254	9.0
WT at start of mating (kg)	50.3	44.8	45.4	7.1	48.2	42.1	41.5	6.7
WT at end of mating (kg)	52.5	46.7	48.1	7.2	49.5	45.0	44.3	6.5
WT at kidding (kg)	57.2	56.1	57.3	7.7	57.0	55.4	55.5	6.3
Litter size	1.87	1.73	1.87	0.53	1.70	1.54	1.57	0.64
60-d† milk yield	123	139	152	33.2	109	101	106	28.1
Feed intake (g/h/d) until the end of mating								
Concentrate	949	827	829	–	1257	982	982	–
Hay	314	277	275	–	195+	172+	172+	–

†Postweaning period, feed intake (g/h/d) from the end of mating to 6 weeks prepartum: trial 3 conc. 860, hay 465, trial 4 conc. 750, straw 550; during the last 6 weeks of pregnancy: trial 3 conc. 900, barley hay 400, alfalfa hay 400; trial 4 conc. 1120, straw 550.
+Straw.

Results and discussion

As it was expected in all 4 trials animals on the high plane of nutrition (treatment A) consumed more feed than those on treatments B and C (medium plane of energy nutrition) (Tables 1 and 2). As a result, they attained higher BW at mating. There was no difference in feed intake between animals on treatment B and C. Neither level of feeding (group A vs groups B and C) nor the additional protein (group B vs group C) before the start and until the end of mating had an effect on age at mating, litter size, number of animals delivering and postweaning milk yields in animals of both species born in autumn or spring (Tables 1 and 2). Conception rate was similar in the three groups (trial 1 A 94, B 97, C 97%; trial 2 A 88, B 79, C 96%; trial 3 A 83, B 88, C 94%; trial 4 A 94, B 97, C 93%).

Molle *et al*. (1995) showed that Sarda ewes flushed by feeding soybean meal had a significantly higher ovulation rate than ewes fed whole corn grain although it did not result in a substantial increase in prolificacy. This result is similar to ours but differs from that of Landau (1993) who reported improved prolificacy in several breeds as a result of flushing.

The non-significant effect of BW at mating on litter size differs from the results of Coop (1962) and Gunn *et al*. (1986) in which lower performance in the young sheep was attributed to their lower BW compared to adult sheep. The results however, are similar to those of Havrevoll *et al*. (1995) where kids with higher BW at mating were not more productive than kids on a low plane of nutrition and of lower BW at mating. Furthermore, in our studies in line with those of Havrevoll *et al*. (1995), the low plane of nutrition did not adversely affect milk yield compared to high plane of feeding up to mating.

Based on the findings of the present studies it can be concluded that there is no need for BW greater than 44 kg at mating or for additional (>14% CP DM) dietary protein 3 weeks prior to the start and until the end of mating to attain higher productive and reproductive performance in Chios ewe lambs and Damascus goat kids.

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