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Effects of body condition and level of nutrition before mating on fertility of Awassi ewes

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SUMMARY - Twelve weeks before mating 234 Awassi ewes aged 2.5 to 8.5 years were allocated to a 3x3 design, with 3 body condition scores, 1.5 (C₁), 2.0 (C₂) and 2.5 (C₃), at 5 weeks before mating, and 3 levels of nutrition, 0.5 maintenance (L₁), maintenance (L₂) and 3 times maintenance (L₃) in the 5 weeks before mating. From weeks 12 to 5 before mating, the ewes were fed above or below maintenance until they achieved their designated body condition. Only data from 69 slaughtered ewes and 113 lambed ewes that were mated at the second oestrus after synchronization were analysed. The mean condition scores at five weeks before mating were 1.51, 1.96 and 2.46 for treatments C₁, C₂ and C₃ respectively, and at mating 1.62, 2.03 and 2.60 for treatments L₁, L₂, and L₃, respectively. The mean numbers of *corpus lutea* in slaughtered ewes were 1.07, 1.30 and 1.38 for treatments C₁, C₂ and C₃ (P<0.05), and 0.85, 1.29 and 1.48 for L₁, L₂ and L₃ (P<0.01). Combining data of the slaughtered and lambed ewes (n=182) indicated significant effects of both initial body condition (P<0.05) and of feeding level (P<0.01), with means of 0.90, 1.04 and 1.17 for C₁, C₂ and C₃, and of 0.87, 1.06 and 1.15 for L₁, L₂ and L₃, respectively.

Key words: Body condition, level of nutrition, fertility, ewes.

RESUME - "Effets sur la fertilité de brebis Awassi de l'état corporel et du niveau de nutrition avant l'accouplement". Douze semaines avant l'accouplement 234 brebis Awassi âgées de 2,5 à 8,5 ans ont été réparties selon un dispositif 3x3, avec 3 notes d'état corporel, 1,5 (C₁), 2,0 (C₂) et 2,5 (C₃), à 5 semaines avant l'accouplement, et 3 niveaux de nutrition, 0,5 entretien (L₁), entretien (L₂) et 3 fois l'entretien (L₃) pendant les 5 semaines avant l'accouplement. Depuis la semaine 12 à 5 avant l'accouplement, les brebis ont été alimentées au-dessus ou en-dessous de l'entretien jusqu'à ce qu'elles atteignent l'état corporel qui leur avait été assigné. On n'a analysé que les données provenant de 69 brebis abattues et 113 brebis ayant agnelé, qui avaient été accouplées lors des deuxième chaleurs après la synchronisation. Les notes moyennes d'état corporel à cinq semaines avant l'accouplement étaient de 1,51, 1,96 et 2,46 pour les traitements C₁, C₂ et C₃ respectivement, et à l'accouplement, de 1,62, 2,03 et 2,60 pour les traitements L₁, L₂, et L₃, respectivement. Les nombres moyens de corpus lutea chez les brebis abattues étaient de 1,07, 1,30 et 1,38 pour les traitements C₁, C₂ et C₃ (P<0,05), et de 0,85, 1,29 et 1,48 pour L₁, L₂ et L₃ (P<0,01). La combinaison des données des brebis abattues et ayant agnelé (n=182) indiquait des effets significatifs aussi bien de l'état corporel initial (P<0,05) que du niveau d'alimentation (P<0,01), avec des moyennes de 0,90, 1,04 et 1,17 pour C₁, C₂ et C₃, et de 0,87, 1,06 et 1,15 pour L₁, L₂ et L₃, respectivement.

Mots-clés : Etat corporel, niveau de nutrition, fertilité, brebis.

Introduction

Surveys of flocks in West Asia have shown that lambing percentages of Awassi ewes are rarely above 85% and are often as low as 60% (Kassem *et al.*, 1989; Thomson *et al.*, 1989). This is a major cause of the low output of sheep systems in the region. Low fertility results from a combination of poor nutrition and management, disease and, possibly, the effects of high temperatures at mating, which generally occurs in mid-summer.

Body weight at mating has been shown to affect reproductive performance in studies using flock records. Thomson and Bahhady (1988) found a curvilinear relationship between fertility, defined as the number of ewes lambing as a percentage of ewes put with the ram, and body weight at mating. Fertility was 100% in ewes weighing more than 50 kg. Twinning rate was 2 to 4% in ewes weighing more than 41 kg. Kassem *et al.* (1989) found an increase in lambing percentage (lambs born per 100

ewes lambing) of 0.3 to 1.3 ± 0.29 for each kg increase in body weight before mating. Neither of these studies was, however, specifically designed to investigate the effects of weight or body condition and level of nutrition before mating on reproduction in Awassi ewes.

Materials and methods

A 3x3 factorial design was used to investigate the effects of body condition five weeks before mating and level of nutrition in the five weeks before mating on reproductive performance in two groups of ewes, cull ewes, slaughtered to assess the numbers of *Corpora lutea* and foetuses, and ewes taken through to lambing. The treatments were body condition scores (Russel *et al.*, 1969) 5 weeks before mating of 1.5 (C_1), 2.0 (C_2), 2.5 (C_3), and levels of nutrition in the 5 weeks before mating of 0.5 maintenance (L_1) maintenance (L_2) and 3 times maintenance (L_3), as defined in MAFF (1984) for sheep kept outdoors.

The experiment was carried out on ewes which are typical of those in northern Syria. The ewes in the ICARDA flock were purchased between 1979 and 1985 from the Wadi el Azeb Sheep and Range Centre, which had obtained ewes from Bedouin flocks in north west Syria. Between 1989 and 1990 the mean twinning rate in the flock was 8% in ewes that lambed.

Twelve weeks before mating, 234 Awassi ewes aged 8.5 to 2.5 years were allocated to the nine treatments. The overall allocation per treatment was 4 ewes aged 2.5, 3.5, 4.5, 5.5 and 6.5 years and 3 ewes aged 7.5 and 8.5 years. A group of 89 cull ewes were slaughtered at approximately 60 days after mating and consisted of 3 ewes per treatment aged 7.5 and 8.5 years, 2 ewes aged 6.5 or 5.5 and 2 ewes aged 4.5 or 3.5 years. After slaughter the reproductive tracts were removed and the numbers of *Corpora lutea* and foetuses recorded. The wastage of ova was calculated as the difference between the numbers of *Corpora lutea* and foetuses. The lambed group consisted of 145 ewes aged 2.5 to 6.5 years, in which the number of lambs born alive and dead was recorded.

From weeks 12 to 5 before mating, the ewes were fed above or below maintenance until they achieved their designated body condition, when they were transferred to maintenance. From five weeks before mating the ewes were individually fed at the designated levels using vetch hay and a concentrate consisting of 83% barley, 15% cotton seed meal and 2% salt, mineral and vitamin supplement. The approximate daily intakes of fresh feeds were L_1 400 g of hay, L_2 400 g of hay and 350-450 g of concentrate, and L_3 800 g of hay and 1300-1700 g of concentrate. Mating on 1 September was to the second oestrus after synchronization with sponges. At mating, all ewes were transferred to a maintenance level of nutrition.

Chi-square analysis was made of the numbers of *Corpora lutea*, foetuses, losses and lambs born from 69 ewes in the slaughter group and 113 ewes in the lambed group, which did not return to oestrus after mating on 1 September. Likelihood ratio chi-square values and significance level are given in Tables 2 and 3. Analyses of variance were made on the body condition scores and live weights.

Results and discussion

The treatments did not significantly affect the number of ewes that became pregnant at the oestrus on 1 September.

Tables 1 and 2 show the results for the slaughtered ewes. Mean initial body condition scores five weeks before mating on treatments C_2 and C_3 were approximately 0.25 of a condition score below the designated scores. The individual treatment means (Table 1) show a general response in ovulation rate with final condition score at mating. Treatments C_1L_3 , C_2L_3 , C_3L_2 and C_3L_3 with final condition scores above 2.1 had ovulation rates between 1.36 and 1.67. Initial body condition five weeks before mating significantly ($P < 0.05$) affected the mean number of ova and of foetuses per ewe. The three levels of nutrition in the five weeks before mating resulted in mean changes in body condition of -0.3, +0.05 and +0.59 and in live weight of -4.4, +0.2 and +7.1 kg, in ewes on treatments L_1 , L_2 and L_3 , respectively. Level of nutrition had significant effects ($P < 0.01$) on the number of *Corpora lutea* and of foetuses. Mean wastage of ova ranged from 12 to 22% and was not significantly ($P > 0.05$) affected by

treatment. These levels of ova wastage, caused by a combination of failure of fertilization and early embryo loss, are similar to those in studies in other breeds (e.g., Rhind *et al.*, 1989).

The 113 ewes that lambled had treatment means for body condition close to the designated levels. The changes in body condition on treatments L₁, L₂ and L₃ were -0.40, +0.06 and +0.62, respectively. The number of lambs born not was affected significantly ($P>0.05$) by treatment.

Table 1. Treatment means for initial and final body condition score, live weight and numbers of *Corpora lutea* and fetuses per ewe slaughtered at approximately 60 days after mating on 1 September

Treatment	C ₁ L ₁	C ₁ L ₂	C ₁ L ₃	C ₂ L ₁	C ₂ L ₂	C ₂ L ₃	C ₃ L ₁	C ₃ L ₂	C ₃ L ₃
n	9	8	11	7	7	6	4	9	8
Initial score	1.44	1.44	1.50	1.71	1.79	1.79	2.31	2.25	2.31
Final score	1.22	1.50	2.14	1.46	1.86	2.42	1.81	2.25	2.81
Initial weight (kg)	42.8	44.1	45.9	50.6	50.1	47.8	56.0	54.6	56.8
Final weight (kg)	39.3	44.3	54.2	46.1	51.4	56.3	50.5	54.1	61.1
No. <i>Corpora lutea</i>	0.67	1.12	1.36	1.00	1.29	1.66	1.00	1.44	1.50
No. fetuses	0.56	0.88	1.00	0.86	1.00	1.67	0.50	1.44	1.25

Table 2. Means and standard errors for main effects of initial body condition score and level of feeding before mating on body condition score, live weight and numbers of *Corpora lutea* and fetuses in ewes slaughtered at approximately 60 days after mating on 1 September

	Initial body condition score							Level of nutrition						
	C ₁	SE	C ₂	SE	C ₃	SE	Sign	L ₁	SE	L ₂	SE	L ₃	SE	Sign
n	28		20		21			20		24		25		
Initial score	1.46	0.044	1.76	0.053	2.29	0.085	***	1.71	0.095	1.84	0.081	1.83	0.104	NS
Final score	1.66	0.086	1.89	0.103	2.38	0.115	***	1.42	0.070	1.89	0.080	2.42	0.092	***
Initial wt (kg)	44.4	0.827	49.6	1.164	55.7	1.484	***	48.2	1.608	49.8	1.400	49.8	1.516	NS
Final wt (kg)	46.6	1.453	51.0	1.331	56.1	1.653	***	44.0	1.477	50.0	1.313	56.9	1.183	***
No. <i>C.lutea</i>	1.07	0.125	1.30	0.105	1.38	0.109	*†	0.85	0.109	1.29	0.095	1.48	0.117	***††
No. fetuses	0.82	0.126	1.15	0.109	1.24	0.152	***†††	0.70	0.128	1.13	0.091	1.24	0.156	***††††

$\dagger\chi^2 = 9.99$; $\dagger\dagger\chi^2 = 18.91$; $\dagger\dagger\dagger\chi^2 = 9.47$; $\dagger\dagger\dagger\dagger\chi^2 = 18.81$

NS: non significant; * $P<0.05$; ** $P<0.01$; *** $P<0.001$

The data for the slaughtered and lambled groups were combined (Table 3), assuming that losses of fetuses after 60 days of pregnancy are negligible. There was no significant difference between the slaughtered and lambled groups in initial and final weights or in number of fetuses, with means of 49.2 and 51.0±0.54 kg, 50.6 and 52.1±0.64 kg and 1.03 and 1.04±0.042 for the slaughtered and lambled groups, respectively. The small differences in initial and final body condition between the groups were, however, significant ($P<0.001$), with means of 1.80 and 2.10±0.035 and 1.94 and 2.21±0.043 for initial and final body condition for the slaughtered and lambled groups, respectively. Table 3 shows significant effects of both initial body condition ($P<0.05$) and level of nutrition ($P<0.01$) on the number of fetuses per ewe in the combined data.

Table 3. Means and standard errors for main effects of initial body condition score and level of feeding before mating on body condition score, live weight and number of foetuses in the combined group of ewes

	Initial body condition score							Level of nutrition						
	C ₁	SE	C ₂	SE	C ₃	SE	Sign	L ₁	SE	L ₂	SE	L ₃	SE	Sign
n	62		55		65			55		62		65		
Initial score	1.51	0.030	1.96	0.040	2.46	0.043	***	1.98	0.068	1.98	0.059	2.00	0.065	NS
Final score	1.73	0.060	2.08	0.065	2.50	0.065	***	1.62	0.052	2.03	0.058	2.60	0.055	***
Initial wt (kg)	44.4	0.615	50.4	0.732	56.0	0.738	***	49.6	1.007	50.1	0.917	51.3	0.888	NS
Final wt (kg)	46.9	0.992	51.9	1.088	55.8	0.893	***	44.4	0.835	50.8	0.868	58.5	0.722	***
Lambs/ewe	0.90	0.075	1.04	0.063	1.17	0.075	*†	0.87	0.064	1.06	0.064	1.15	0.083	***††

† $\chi^2 = 10.51$; †† $\chi^2 = 16.18$

NS: non significant; *P<0.05; **P<0.01; ***P<0.001

Conclusions

This experiment indicates that Awassi ewes have similar responses of lambing percentage to body condition and level of nutrition before mating to those in breeds of European origin. The ovulation rate of ewes with body condition scores above 2.25, which is not common in commercial flocks, indicates that the Awassi breed has a higher potential prolificacy than has previously been reported. During the main mating period, flocks in West Asia usually graze stubbles without supplementation. Rihawi *et al.* (1993) found that intakes on stubble varied from twice to 0.25 of maintenance as stubble was grazed down. It is unlikely, therefore, that the highest and lowest energy intakes in this experiment would occur for as long as 5 weeks. The effects of shorter periods of high, low, and fluctuating levels of nutrition on ovulation rate in Awassi ewes require investigation.

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