

## COMPARATIVE PERFORMANCE OF DAMASCUS GOATS AND CHIOS EWES IN OMAN

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### Summary

Twenty growing female Damascus (Shami) goats and twenty growing Chios ewes of two mating ages (10 and 12 months) were used to study the effect of mating age (MA) on reproductive performance (RP). In addition to (RP), The growth, milk production and nutrient requirements were also evaluated. A complete random design in a  $2 \times 2$  factorial was used, with (MA) and species as the main factors. (MA) had no effects on (RP), milk production and mortality. No significant difference ( $p > 0.05$ ) were observed between (MA) or between species, for age at kidding/lambing (K/L). Sheep reached puberty earlier than goats. Average age (months) at conception and at (K/L) was 15.8; 20.8 and 17.0; 22.0 for sheep and goats respectively. Body weight (BW), rather than age was the most important factor determining puberty. Both goats and ewes conceived when they reached about 67% of their mature (BW) for goats and 85% for ewes. Sheep grew faster than goats, but the latter had higher twinning (67.8% versus 25%). Chios sheep were suitable for meat and Shami goats for dairying or dual purpose systems. Nutrient requirements for growth of goats and ewes were similar with an average DM-intake of about 4% (BW); 12-13% CP and 65-69% TDN (DM-basis) of the total ration. It is recommended to breed Chios ewes at a (BW) of at least 50 kg and Shami does at 38 kg, irrespective of their age.

(Key Words : Performance, Chios Ewes, Damascus Goats, Mating Age)

### Introduction

The number of goats and sheep in Oman is estimated to be around one million with goats being greater in number (about 89300) and preference than sheep. However, both goats and sheep play a major role in meeting the demand for meat and milk. Even though the Omani goats are very much preferred for their meat by the Omani nationals, however research results indicated that they are relatively lower in production potential compared to exotic breeds of goats such as Shami and Anglo-Nubian (Al-Serafi, 1991). The same observations are true for local sheep. Exotic breeds of goats (Shami) and sheep (Chios) were introduced by the Ministry of Agriculture and Fisheries (MAF) during 1991 to study their performance and adaptation to the local conditions and finally to upgrade local goats and sheep by crossbreeding with those reputed exotic breeds.

Good nutrition and high standards of management are needed for the Chios sheep to attain their potential. The Chios sheep was known to be an excellent breed in the area of the Near East, characterized by its high prolificacy and high milk yield (Lysandrides, 1987). Damascus goat was said to be a highly fertile breed with a conception rate of about 80% at first mating and a maternal performance of 1.5 for litter size at weaning and 27.0 kg for litter weight at weaning with a high milk production of 520-558 kg per lactation in Cyprus (Constantinou, 1987).

Early breeding of goats and sheep will tend to reduce the unproductive phase of the animal's life and may therefore increase income (Constantinou, 1987). However, early breeding depends mainly on proper feeding and management (Skjevdal, 1982). Good feeding which improves the growth rate of the animal and allows it to reach puberty at an earlier age; selection of sexually mature females of good body size and the right decision by the husbandman to mate at the optimal time are highly desired for successful sheep and goat production enterprises. With the above ideas in mind the objectives of the study were:

(1) To assess the optimal mating age for both Shami

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goats and Chios ewes,

(2) To predict the nutrient requirements for growth, from weaning to puberty for Shami goats and Chios ewes,

(3) To determine and compare growth rate, milk production and reproductive performance of Shami goats and Chios sheep.

## Materials and Methods

### Livestock

Twenty Shami doe kids and twenty Chios ewe lambs, all born during the same season (winter) were used in this study. All the goats and sheep were weaned at three months of age after full suckling of their dams with creep feeding of a commercial concentrate diet (14% CP) at a rate of about 200 g/head/day with *ad. libitum* amounts of green Rhodes grass (*Chloris guyana*) prior to weaning. All the goats and sheep were more or less of the same age.

### Experimental design

A complete random design in a  $2 \times 2$  factorial was used in this study, with two species (goats and sheep) and two mating ages (10 months and 12 months) with ten animals/treatment. Both goats and sheep were allocated at random to either mating ages at 10 months or at 12 months-old.

### Feeding and management

Post weaning and until kidding/lambing, all the animals were fed according to NRC (1975); using a commercial concentrate diet (14% CP) at an average rate of 0.75 kg/head/day in addition to *ad. libitum* amounts of green Rhodes grass with free access to trace mineralized salt lick blocks and clean water. Each group of the goats (ten females + one male) and ewes were housed in one pen equipped with adequate water and feed facilities. The animals were all group-fed. Just prior to kidding/lambing (last month of pregnancy), each female was given 150 g of ground barley daily in addition to the concentrate and Rhodes grass mentioned before. During lactation all the goats and sheep were fed at a rate of 1.25 kg/head/day of the same commercial concentrate (14% CP) fed before in addition to *ad. libitum* amounts of green Rhodes grass, salt licks and clean water.

From birth of females until their mating, all the animals were weighed monthly. Liveweight of the offsprings born by the does and ewes at the two mating groups were recorded from birth till weaning at three months. The experiment continued for about twenty seven months. Litter size and litter weight at birth and weaning were recorded, in addition to mortality rate. Conception

rate and fertility were also computed.

Feed intake was recorded. Samples of consumed feeds were analysed in the laboratory once every month, during the progress of the trial according to (AOAC, 1984).

Data was statistically analysed as a  $2 \times 2$  factorial design according to Steel and Torrie (1980). Mean values, standard deviation (SD), range and coefficient of variation (CV) for age at first kidding/lambing and age at conception were computed. Age at conception was calculated by deducting 150 days from the actual kidding/lambing age for goats & sheep. Milk production was measured by hand milking five animals/week from each group of goats and ewes until drying. Dams were separated from their kids/lambs for 24 hrs before milking.

## Results

Table 1 summaries the age in months at kidding/lambing and at conception for Shami goats and Chios ewes bred at 10 and 12 months. Age at the start of mating did not have any significant effect ( $p > 0.05$ ) on kidding/lambing age. However, in general, ewes seemed to reach puberty and to lamb relatively earlier than goats, but there was no significant differences between species ( $p > 0.05$ ) for kidding/lambing age or age at first conception. In general, range for kidding/lambing age was higher for the groups for which males were introduced at 10 months than at 12 months-old. The variation being greater in sheep than in goats as shown by the relatively high CV values for sheep (3.2-5.2%) compared to goats (1.4-3.3%).

In goats, unlike sheep, the group bred at 10 months-old seemed to deliver relatively earlier than the group bred at 12 months. Only one goat out of the twenty goats (5%), conceived before 12 months of age (at 10.3 months), its weight was 38 kg at mating and the average mating weight for this group was  $29.4 \pm 4.5$  kg (table 5).

In sheep, four ewes conceived between 11.7 to 12 months of age (about 20% of the sheep) in this study. Their weights ranged between 45-53 kg with a mean weight of 50.3. Mean weight of this group was  $44.4 \pm 6.7$  kg. These results again demonstrate that sheep reached puberty earlier than goats.

Table 2 summaries the effects of mating age on maternal or reproductive performance of Shami goats and Chios ewes. Mating age did not have any significant effects on fertility or litter size at birth or at weaning. In general, twinning was higher in goats (67.8%) than in sheep (25%). The high twinning in goats was reflected in an increase in litter weight of goats both at birth and at weaning compared to sheep.

Mortality in sheep was not affected by mating age,

TABLE 1. AVERAGE AGE (MONTHS) AT KIDDING /LAMBING (K /L) AND AT CONCEPTION (C) OF THE SHAMI GOATS AND CHIOS EWES BRED AT 10 AND 12 MONTHS-OLD

Trait	Shami goats age at the start of mating		Chios ewes age at the start of mating		SE
	10 months	12 months	10 months	12 months	
No. of animals	10	9	10	10	
Age at K/L	21.2 $\pm$ 0.7*	22.84 $\pm$ 0.33	21.4 $\pm$ 0.7	20.2 $\pm$ 1.0	0.7 NS
% C.V.	3.3	1.4	3.2	5.2	
Range for K/L age	15.3 – 22.6	21.5 – 24.67	16.7 – 24.3	17 – 24.6	
Overall mean K/L age	22.0		20.8		
Calculated age at (C)	16.2 $\pm$ 0.7	17.84 $\pm$ 0.33	16.4 $\pm$ 0.7	15.2 $\pm$ 1.0	0.73 NS
C.V. % for age at (C)	4.3	1.85	4.26	6.57	
Range for age at (C)	10.3 – 17.6	16.5 – 19.67	11.7 – 19.3	12 – 19.6	
Overall mean age at (C)	17.0		15.8		

\*  $\pm$  Standard deviation.

TABLE 2. EFFECTS OF MATING AGE ON REPRODUCTIVE PERFORMANCE OF SHAMI GOATS AND CHIOS EWES

Trait	Shami goats age at the start of mating		Chios sheep age at the start of mating	
	10 months	12 months	10 months	12 months
Number of goats/ewes (g/e) available for mating	10	10	10	10
No. of animals K/L	10	9	10	10
Fertility (%)	100	90	100	100
No. of g/e giving birth to singles	2 (20%)*	4 (44.4%)*	7 (70%)*	8 (80%)*
No. of g/e giving birth to twins	8 (80%)*	5 (55.6%)*	3 (30%)*	2 (20%)*
Overall mean for twinning (%)	67.8		25	
**Prolificacy or litter size at birth (LSB)	1.7	1.4	1.3	1.2
Overall mean LSB	1.55		1.25	
Litter weight at birth (LWB) (kg)	5.53	4.86	4.45	5.0
Overall mean LWB (kg)	5.20		4.73	
Litter size at weaning (LSW)	1.5	1.3	1.3	1.2
Overall mean LSW	1.40		1.25	
Litter weight at weaning (LWW) (kg)	25.60	22.5	27.2	22.0
Overall mean LWW (kg) (3 months)	24.0		24.6	
No. of dead kids/lambs from birth to weaning (3 months)	3	1	0	0
% mortality from birth to weaning	16.6	7.1	0	0

\* No. between parentheses refer to % single births or to twinning %.

\*\*Prolificacy is equivalent to litter size which is = No. of kids/lambs born alive divided by no. of does/ewes K/L.

however, in goats the group which was mated at 10 months had relatively higher mortality than the other group.

In both goats and ewes, fertility was very high and

ranged between 90-100%. The effects of breeding age on birth weight and growth rate of born kids and lambs (females) is listed in table 3. In general, breeding age did not have any effects on birth weights of kids/lambs.

Weaning weights for females were not affected by the breeding age of their dams either. Growth rate of off-springs from birth to weaning was not affected by the breeding age of their dams.

TABLE 3. EFFECTS OF MATING AGE ON BIRTH WEIGHT AND GROWTH RATE FROM BIRTH TO WEANING OF FEMALE OFF-SPRINGS BORN BY SHAMI DOES AND CHIOS EWES

Trait	Shami goats age at the start of mating		Chios sheep age at the start of mating	
	10 months	12 months	10 months	12 months
No. of kids/lambs born alive	15	12	13	12
Sex ratio of males to females	10 : 5	7 : 5	9 : 5	6 : 6
Birth weight (BW) for males (kg)	3.35	3.65	4.2	4.3
BW for females (kg)	3.2	3.30	3.75	3.10
*pooled BW (males + females) (kg)	3.25	3.45	4.0	3.7
Overall mean pooled BW (kg)		3.35		3.85
** weaning weight (WW) for females (kg)	16.8	17.0	19	18.5
Overall mean WW for females		17.0		18.8
Growth rate from birth to weaning (GRBW), (g/day) for females	151.0	152.2	169.4	171.0
Mean GRBW (g/day) for females		151.6		170

\* There was no significant differences ( $p > 0.05$ ) between mating age on birth weight, however, there was a significant difference between sheep and goats ( $p < 0.05$ ) for birth weight. No significant interaction ( $p > 0.05$ ) between mating age and animal species on birth weight.

\*\* Weaning age was = 3 months.

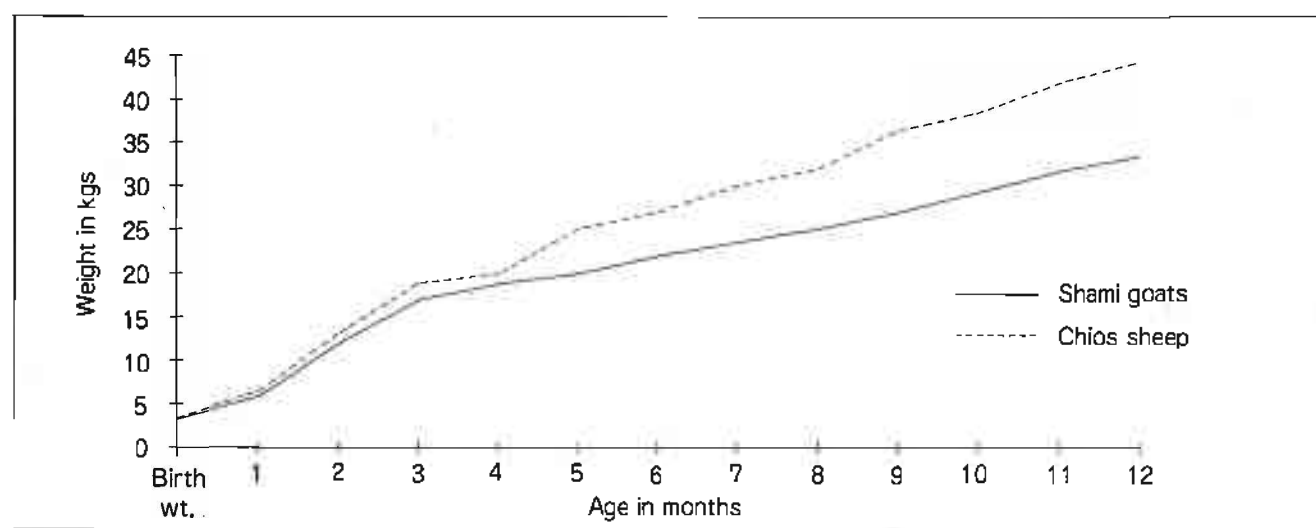


Figure 1. Growth curve of female Shami goats and Chios ewes from birth to one year-old.

In general, sheep grew faster than goats both at pre-weaning (table 3) and post weaning intervals as well as from birth to mating time (table 5 and figure 1).

Table 4 summaries the effects of mating age on milk

production and lactation length by Shami goats and Chios ewes. Breeding age had no significant effects ( $p > 0.05$ ) on both length of lactation or total milk production by goats and sheep. However, there was a significant

difference ( $p < 0.05$ ) between goats and sheep in total milk production, with Shami goats producing almost double the amount of milk produced by sheep.

Chios sheep had higher butter fat content (6.5%) than Shami goats (3.5%). Shami goats were more efficient in converting feed into milk than Chios sheep (table 4).

TABLE 4. EFFECTS OF MATING AGE ON MILK PRODUCTION (MP) AND LENGTH OF LACTATION (LL) SEASON OF SHAMI GOATS AND CHIOS SHEEP

Trait	Shami goats age at mating		Chios sheep age at mating	
	10 months	12 months	10 months	12 months
LL [days]	255	191	243	245
Range of LL (days)	149 - 330	162 - 205	210 - 258	143 - 340
Total MP per lactation (litres)	181	126	75	80
Mean MP (litres/lactation)	153.5		77.5	
Average daily MP (litres)	0.71	0.66	0.31	0.33
Mean daily MP (litres)	0.68		0.32	
Range for daily MP (litres)	0.46 - 0.87	0.2 - 1.3	0.2 - 0.44	0.23 - 0.45
% fat in milk	3.5	3.52	6.4	6.5
Mean, % fat in milk	3.5		6.5	
* Efficiency of converting feed into milk (kg conc./kg of milk)	1.8		3.9	

\* Feed intake during lactation was based on a daily intake of 1.25 kg concentrate/head in addition to *ad. libitum* amounts of green Rhodes grass and free access to water and mineral blocks for both goats and sheep.

Table 5 shows body weight at mating, growth, feed intake, efficiency of feed conversion into gain and nutritive value of the consumed feeds by growing female Shami goats and Chios sheep from weaning to mating time.

It was obvious that both goats and ewes mated at 12 months had heavier body weights than the group bred at 10 months. However, there was no significant difference ( $p > 0.05$ ) between body weights at 10 and 12 months, but there was a significant difference ( $p < 0.05$ ) between goats and sheep, with sheep being heavier than goats at both mating times.

There were no significant differences ( $p > 0.05$ ) in growth rate for both goats and sheep at the two mating times, however, sheep grew faster than goats with a significant difference ( $p < 0.05$ ) between the two species for growth rate post weaning (until mating time). Sheep consumed more feed than goats but they were more efficient (12.4-13.1 g feed/g gain) in converting feed into gain compared to goats (15.4-16.4 g feed/g gain). Feed intake expressed on the basis of metabolic body weight ( $W^{0.75}$ ) was also high for sheep compared to goats (table 5).

Nutrient requirements for growth for both goats and

sheep were very similar, however, goats required slightly more protein and energy than sheep.

Table 6 summaries the nutrient composition of the feeds and mineral blocks used for feeding both goats and sheep during growth and lactation. Rhodes grass seemed to be a good forage of a moderate nutritive value where as the commercial concentrate (14% CP) was very nutritive and both feeds were palatable and supported excellent growth rates for both sheep and goats. The mineral block contained all the needed macro and micro minerals together with vitamin D.

## Discussion

Age at mating in this trial, or age when both Shami goats and Chios ewes were first bred did not exert any effects on productive or reproductive performance. Body weight (condition) rather than mating time or age of the animal was the most important factor determining attainment of puberty. Well fed heavier animals conceived relatively earlier than light weight animals.

These findings are in agreement with El Houssni and El Hafiz (1982) who found that Ossimi and Barki ewe lambs in Egypt when reared on a high plane of nutrition

TABLE 5. BODY WEIGHT (BW) AT MATING [kg]; FEED INTAKE; GROWTH; FEED CONVERSION (FC) EFFICIENCY FOR GROWTH OF FEMALES FROM WEANING TO MATING TIME AND NUTRITIVE VALUE OF THE CONSUMED DIETS BY THE GROWING SHAMI GOATS AND CHIOS EWES

Trait	Shami goats age at the start of mating		Chios sheep age at the start of mating	
	10 months	12 months	10 months	12 months
Birth weight of females (kg)	3.2	3.3	3.7	3.1
Weaning weight of females (kg)	16.8	17.0	19	18.5
Weight at mating time (kg)	29.4 ± 4.5	33.5 ± 3.85	38.6 ± 4.7	44.4 ± 6.7
Growth rate from weaning to mating (g/day)	60	61	93	96
Average growth rate from birth to mating (g/day)	87.3	84	116.3	114.7
Average BW of females from weaning to mating (kg)	23.1	25.3	28.8	31.5
Average metabolic BW ( $W^{0.75}$ ) from weaning to mating	10.5	11.3	12.4	13.3
Average daily feed intake (from weaning to mating):				
Concentrate (g/head/day)	750	750	750	750
Green Rhodes grass (g/head/day)	(1,250)	(1,625)	(2,375)	(2,925)
Concentrate to roughage ratio (DM-basis)	73:27	68:32	59:41	52:48
Total DM-intake (g/head/day)	925	1,000	1,150	1,260
FC (g feed/g gain)	15.4	16.4	12.4	13.1
Daily DM-intake (g/kg $W^{0.75}$ )	88	88.5	92.7	94.7
DM-intake, as % BW	4.0	4.0	4.0	4.0
Nutritive value of the consumed diets during growth (DM-basis):				
% CP	12.6	12.4	12.0	11.7
% CF	13.8	15.2	17.6	19.0
% TDN	68.5	67.6	66.0	65.0

TABLE 6. NUTRITIVE VALUE\* OF THE CONSUMED DIETS (DM-BASIS) BY THE GOATS AND EWES DURING THE TRIALS

Nutrient	Feed	
	Rhodes grass (green)	Commercial conc. (14% CP)
DM	20.0	90.0
CP	9.0	14.0
CF	34.0	6.3
EE	1.5	1.6
Ash	11.3	7.6
NFE	44.2	70.5
% TDN	55.0	73.5

\*In addition to both Rhodes grass and the concentrate diet, animals were allowed free access to salt-licks containing (in addition to NaCl): Ca, 1.3%; P, 0.23%; Mg, 0.3%; Mn, 200 mg/kg; Co, 124 mg/kg; I, 190 mg/kg; Zn, 120 mg/kg; Fe, 1,690 mg/kg; Se, 10 mg/kg; Cu, 400 mg/kg and Vit. D<sub>3</sub>, 40,000 IU/kg.

had shorter puberty age (347 days) than when fed on a low plane of nutrition (366 days). Findings obtained in this study are also in agreement with the findings of Gunn and Doney (1979) and Gunn, Doney and Smith (1979), who reported that reproductive performance was influenced by nutrition and body condition or liveweight, especially during the immediate pre- and post mating period.

By looking at the reproductive performance of Shami goats and Chios ewes in this study, it was clear that Chios sheep reached puberty relatively earlier than goats, this could be attributed to the high growth rate (both pre- and post weaning) of Chios sheep compared to Shami goats (table 3 and 5).

It is interesting to note that average mating (at 10 and 12 months) weight for goats ranged between 29.4 and 33.5 kg and for ewes it ranged between 38.6 and 44.4 kg. Although ewes were heavier in their body weight than goats at mating, but they reached puberty relatively earlier than goats.

These findings implicate that conception rate was

largely influenced by growth rate or nutrition. Average mature weight of ewes after the second lambing was found to be 58.5 kg and for Shami goats (after the second kidding) was found to be 56.6 kg in this station. By expressing the weights of the animals which conceived at an earlier age to the mature female weights after second kidding/lambing, it was  $(38/56.6 \times 100)$  about 67% for goats and  $(50/58.5 \times 100)$  85% for ewes. This shows that the animals which are close to their mature body weight conceived earlier irrespective of their age and could explain why sheep reached puberty or conceived earlier than goats.

Reproductive performance for both goats and sheep obtained in this study was excellent with fertility ranging between 90 and 100%. However, Shami goats were superior to sheep for their high twinning and prolificacy.

Chios sheep grew faster than Shami goats and even though litter size at birth and at weaning was higher for Shami goats but litter weight at weaning was still higher for Chios sheep compared to Shami goats. The high growth rate of the Chios sheep obtained in this study, together with their better efficiency of converting feed into gain compared to Shami goats makes the Chios sheep a better candidate for meat production than Shami goats in the Sultanate. However, Shami goats were more efficient in milk production than Chios sheep. Reproductive performance obtained in this study for both Shami goats and Chios sheep was comparable to performance reported by Constantinou (1987) for Damascus goats in Cyprus and by Lysandrides (1987) for Chios sheep also in Cyprus.

Both Chios ewe lambs and Shami doe kids had very similar nutrient requirements for growth, post weaning and until puberty. These requirements could be stated as a daily DM-intake of about 4% body weight; 12-13% CP (DM-basis) of the total ration and 65-69% TDN.

It is recommended to breed Chios ewes at a body weight of at least 50 kg and Shami does at 38 kg, irrespective of their age.

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