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REPRODUCTIVE AND PRODUCTIVE PERFORMANCE OF HARRI SHEEP BRED CONTINUOUSLY UNDER ARID CONDITIONS

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SUMMARY

The present work was conducted to evaluate performance of Harri ewes run with rams all the year round under arid conditions in Saudi Arabia. Various measures of ewe productivity were estimated (number of lambs born per ewe lambing, number of lambs weaned per ewe lambing, kg born per ewe lambing and kg weaned per ewe lambing). Also, ewe reproductivity (lambing interval and age at first lambing) were analyzed. The productive data involved 1031 lambing records for 528 ewes. However, only 527 records were available to study lambing interval while age at first lambing was estimated in 25 ewes. A total of 1132 lamb birth weights and 899 lamb weaning weights, collected during two successive years, were analyzed for effects of year, month of lambing and sex.

Month of lambing exerted significant effect on kg weaned lambs per ewe lambing and lambing interval. Age at first lambing was significantly affected by month of birth. Based on all ewes joined, most lambings occurred from December to March. However, the highest kg weaned per ewe lambing were in May and June. Both birth weight and weaning weight were significantly affected by all variables studied.

Keywords: Harri sheep, reproductive and productive performance, arid conditions

INTRODUCTION

In most Arab Countries coarse-wool breeds of sheep are raised. Sheep are raised mainly for meat production. Wool clip however, represents a secondary income. Though most breeds are well adapted to the prevailing conditions their productivity is rather low. Younis(1977)discussed in details different avenues to increase meat production from local sheep in Arab countries. Among these avenues, rebreeding was considered. This is due to the fact that local ewes show estrous all the year round (El-Fouly *et al.* 1977, Younis,1977 and Aboul-Naga and Aboul-Ela, 1985).More recently Mokhtar *et al.*(1991) found that 3 lambings / 2 years has increased number of lambs weaned/ewe joined by 52.9% while feed intake was increased only by 29.5%, thus improving efficiency of meat production. Also, Aboul-Naga (1983) found that increasing lambing frequency has increased lamb production by 66,80 and71% for Barki,Rahmani and Ossimi,respectively.

In all previous comparisons continuous breeding, being the practical method adopted by Bedouins in their flocks, was not considered. Therefore, the present work was initiated to estimate lamb production under continuous breeding system in Harri sheep, being the upper ceiling for lamb production of such breed.

MATERIALS AND METHODS

Experimental data

Harri is a fat-tailed coarse woolled sheep, small in size (ewes range from 40 to 45 kg while rams 60 to 70 kg)with white coloured fleece. It is raised in the west region of Saudi Arabia under arid conditions thus tolerating high ambient temperature. Data were derived from a commercial flock of sheep belongs to ADITCo.some 35 km south west of Jeddah kept at latitude 21.4 ^{o}C and longitude 39.5 ^{o}C therefore, it is expected to exhibit oestrus all the year round. Limited information is available concerning reproductive and productive efficiency of Harri sheep. S0, a trial was conducted and covered two years starting from the beginning of September 1989 and continued till end of August 1991 in order to get production records for this breed. In this farm , rams used to run with ewes all the year even before collecting data. It was not possible to analyze productive traits on the basis of all ewes joined. However, collected data represented 1031 lambing records of 528 Harri ewes mated to pure Harri rams. Each ewe had on the average 2 lambing records. Productive traits considered were (1) number of lambs born per ewe lambing (LBEL), (2) number of lambs weaned per ewe lambing (LWEL), (3) kg born lambs per ewe lambing (KGBL) and (4) kg weaned lambs per ewe lambing (KGWL). Lamb traits were (1) birth weight (BW) and (2) weaning weight (WW). Reproductive traits were (1) lambing interval (LI) and (2) age at first lambing (AFL).

Lambs born per ewe lambing was measured by giving a score of unity or two to the ewe which gave birth to one or two viable lamb (s). However, the twinning incidence was rare in the present data. To estimate LWEL, a score of zero, one or two was given for ewes weaned zero, one, or two, lambs,respectively. In calculating KGWL, total weight of lambs weaned was adjusted to 90 days by extrapolation. Lambing interval was measured for ewes which had more than one lambing,i.e, two or three or in few cases four lambings (9 ewes) during the given period in the present trial. Lambing interval was calculated by subtracting the date of lambing from the following one. Age at first lambing was observed in 71 ewe lambs which were born as singles in the first year of the study and accordingly were exposed to rams. Only 34 ewes achieved their first lambing in the second year of the study, nine ewes were excluded from the study because of incomplete records. Therefore, 25 Harri ewe lambs were born in Autumn months (September,October and November) and in March were used to estimate AFL.

Management

Two rams were joined with ewes continuously in separate shaded pens. Number of ewes ranged from 30-50 in each pen. No culling took place in this farm. During lambing , ewes were separated from rams and were kept in individual pens for a

period of 7-10 days only, after which ewes were rejoined again in pens with other rams. Soon after birth,each lamb was ear-tagged and weighed. Lambs suckled their mothers until weaning at about 90 days. Dipping and drenching were practiced for controlling external and internal parasites, respectively. Ewes were fed on a concentrate mixture which was offered at the rate of 1/2 kg per ewe per day plus straw or hay at the rate of 1/2 kg per ewe per day. Fresh water and salt blocks were available at any time.

Statistical procedure

Statistical analysis was conducted by least squares procedures of analysis of data with unequal subclass numbers (Harvey,1987). One mixed model was used to analyze LBEL,LWEL,KGBL,KGWL and LI traits. Effects of year and month of lambing were fixed while ewe was included in the model as a random effect. Also, the interaction of year x month of lambing was studied in the model except for LI. Both lamb traits(BW and WW) were analyzed by one fixed model. The model included the effects of year,month of lambing and sex. Year x month of lambing was the only interaction included in the model. Other two-factors interaction were not included in the model for insufficient numbers in some cells. Another fixed model was used to study effects of month of birth and weaning weight of ewe as a continuous variable (linear and quadratic) on AFL.

RESULTS AND DISCUSSION

Productive traits

Ewe lambing per ewe joined (ELEJ)

Results of ELEJ classified by month are shown in Table 1 and Figure 1. Results show a wide variation among different months in this trait with a clear rise during the period from December to March. This may indicate a similar variability in the magnitude of estrous occurrence in different months with a maximum during the period from July to October. Though El-Fouly *et al*. (1977), Younis(1977) and Aboul-Naga and Aboul-Ela (1985) found that local ewes exhibit estrous all the year round. Aboul-Naga *et al*. (1991) found that there was a significant variation in the breeding activity at different mating seasons. It is of interest to note that 92% of all ewes exposed to rams during the experimental period (2 years) had conceived and gave birth to viable lambs, leaving only 8% as barren ewes. This latter value though is less than other values reported by Younis and Galal (1973), yet it contributes to the total reproductive wastage of this breed. Reasons behind this bareness is not fully known and more research is needed.

Number of lambs born per ewe joined (LBEJ)

The above-mentioned trait was found to be 97%. Comparing the latter value by lambing rate (92%) may indicate a low incidence of twinning. Average litter size (ALS) was found to be only 1.05. Breeds raised under arid and semi-arid conditions have usually a low twinning rate which may be a sort of adaptability to the harsh environmental conditions. In the Egyptian desert, ALS of Barki sheep was found to range from 1.02-1.1 (Ahmed *et al*. 1992).

Number of lambs weaned per ewe joined (LWEJ)

Results in Table 1 indicate another source of production wastage i.e. lambs mortality from birth to weaning being rather high with a value of 20%. This high mortality rate may be due to environmental and/ or managerial factors.

Number of lambs born and weaned per ewe lambing(LBEL and LWEL)

Results of least squares analysis (Table 2) confirmed previous values which were calculated on the raw data. ALS was found to be 1.05 while LWEL was 84, showing mortality rate of about 21%. In general, results indicate a poor productivity for Harri sheep even when ewes were run with rams all the year round. Month of lambing and year had no significant effect on either LBEL or LWEL

Table 1.Percentage of ELEJ, LBEJ and LWEJ as calculated from the raw data.

Month	ELEJ%	LBEJ%	LWEJ%
January	9	10	8
February	10	11	9
March	9	9	7
April	4	4	3
May	6	6	5
June	11	12	10
July	5	5	4
August	6	7	6
September	7	7	6
October	9	9	8
November	5	5	4
December	11	12	7
Total	92	97	77

ELEJ: number of ewes lambing per ewe joined, LBEJ: number of lambs born per ewe joined and LWEJ:number of lambs weaned per ewe joined.

Kg born and weaned lambs per ewe lambing(KGBL and KGWL)

The importance of KGBL arises from expressing the standard of management during the course of pregnancy especially in the later stages. Also, KGBL reflects to some extent the genetic capability of an animal to produce viable lamb(s) in an optimum weight. Results in Table 2 show that KGBL is 2.78 kg which is less than the value (3.94 kg) obtained by Mokhtar (1991) on improved Barki sheep. The lower value of KGBL in the present study is a result of both lower BW and LBEL . Both month of lambing and year had no significant effect on KGBL (Table 2).

Kilogrammes weaned lambs per ewe lambing is a composite trait and reflects to a great extent the level of management and genetic ability of the breed. Although KGWL is independent of conception rate, it is considered one of the most important measures of ewe's productivity since it combines lambing percentage, weaning percentage, mothering ability and weaning weight in the flock in one figure. The value of KGWL obtained in the present study (9.69 kg) is less than the estimate of 13.53 and 20.0 kg previously obtained by Bedier *et al.*(1991) and Moktar(1991), respectively, on Egyptian Barki sheep, being a similar breed to Harri in size. This lower value of KGWL in the present study may be due to low weaning weight of Harri sheep (11.31 kg) plus high mortality rate from birth to weaning being almost 21%.

Results in Table 2 show that KGWL was significantly affected by month of lambing. Also, month of lambing x year interaction had a significant effect on KGWL.

Lamb traits

Birth weight (BW)

The least squares estimate for BW for Harri breed was found to be 2.66 kg which is almost within the same range of 2.99 kg obtained by Eltawil and Narendran(1990) on the same breed. Aboul-Naga *et al.* (1972) and Ahmed *et al.* (1992) working on Egyptian Barki breed obtained an almost close values being 2.69 and 2.90 kg for the same trait, respectively. However, Bedier *et al.*(1996) recorded a higher estimate(3.45 kg). Different estimates obtained by different authors may be due to different environmental effects and managerial procedures under which different flocks were raised, breed differences and also statistical models used for analyses. Results in Table 3 show that BW was significantly affected by both month of lambing and year. Male lambs(2.70 kg) exceeded significantly female ones(2.57 kg) (Table3).

Table 2. Least squares means and standard errors (S.E.) for productive traits.

Classification	No.	LBEL%		LWEL%		KGBL (kg)		KGWL (kg)	
		$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Overall mean	1031[1]	105	1	84	2	2.78	0.03	9.69	0.20
Month of lambing,m		NS		NS		NS		**	
January	99	100	3	81	6	2.92	0.11	9.30	0.73
February	113	107	3	84	7	2.82	0.11	10.23	0.79
March	92	108	3	85	6	2.75	0.09	9.54	0.74
April	44	102	5	84	9	2.94	0.11	9.76	1.15
May	61	101	4	78	7	2.54	0.15	11.03	0.89
June	118	105	3	91	6	2.80	0.11	11.29	0.67
July	68	105	4	95	7	2.80	0.11	9.63	0.83
August	74	106	4	94	7	2.87	0.10	10.35	0.85
September	83	108	4	97	7	2.92	0.11	10.92	0.85
October	104	109	3	75	6	2.90	0.09	7.76	0.70
November	59	102	4	77	7	2.71	0.10	8.66	0.89
December	116	109	3	79	6	2.74	0.10	7.84	0.72
Year (y)		NS		NS		NS		NS	
89/90	568	106	1	87	3	2.83		10.11	0.30
90/91	463	104	1	82	3	2.73		9.28	0.31
Interaction m x y		NS		*		NS		**	
Residual mean square		0.046		0.165		0.428		24.42	
Residual df	479								

LBEL: number of lambs born per ewe lambing , LWEL: number of lambs weaned per ewe lambing , KGBL: kg born lambs per ewe lambing and KGWL: kg weaned lambs per ewe lambing.

1 represents 528 ewes.

NS: nonsignificant, *: P< 0.05 , **: P< 0.01

Weaning weight (WW)

The estimate of 11.31 kg obtained in the present study for WW at 90 days old is less than the value of 15.2 kg reported by Eltawil and Narendran(1990) on the same breed. However, their estimates were derived from small size sample of 25 ewes. Aboul-Naga *et al.*(1972) found that WW of Barki lambs at 4 month of age was 18.42 kg. Ahmed *et al.*(1992) and Bedier *et al.*(1996) working on Barki lambs found that WW to be 15.9 to 22.4 and 15.8 kg respectively, which is higher than the present value. Month of lambing, year and the interaction between them significantly affected WW. As with birth weight, weaning weight was significantly influenced by sex (Table 3). Male lambs exceeded female ones in this trait (11.55 vs 11.07 kg).

Table 3. Least squares means and standard errors (SE) for birth weight and weaning weight (kg).

Classification	No.	Birth weight		No.	Weaning weight	
		$\bar{X}$	SE		$\bar{X}$	SE
Overall mean	1132	2.66	0.02	899	11.31	0.11
Month of lambing		**			**	
January	110	2.68	0.05	90	11.02	0.31
February	118	2.78	0.06	99	11.98	0.35
March	102	2.82	0.05	80	11.67	0.34
April	45	2.55	0.08	37	11.10	0.51
May	70	2.51	0.06	56	13.64	0.40
June	132	2.65	0.04	113	12.49	0.29
July	72	2.66	0.06	60	11.46	0.38
August	82	2.61	0.06	66	10.90	0.36
September	88	2.70	0.06	70	10.59	0.37
October	120	2.74	0.05	99	10.41	0.31
November	63	2.68	0.06	44	9.99	0.43
December	130	2.50	0.05	85	10.46	0.31
Year (y)		*			**	
89/90	620	2.70	0.02	504	11.56	0.15
90/91	512	2.62	0.02	395	11.06	0.15
Sex		**			**	
Male	569	2.74	0.02	437	11.55	0.15
Female	563	2.57	0.02	462	11.07	0.14
Interaction m x y		*			**	
Residual mean square		0.25			8.27	
Residual df		1107			874	

* $p < 0.05$ ** $p < 0.01$

Reproductive traits

Lambing interval (LI)

Breeding efficiency is an important aspect of both natural and man controlled systems of breeding . Lambing interval is of special significance since it shows the ability of an ewe to rebreed again and give birth in a reasonable time. Dickerson(1978) has emphasized that the relative cost of maintaining the breeding

female is much higher in lamb and beef than in swine and poultry production. The author also indicated that genetic potential for reducing both biological and economic costs of lamb production is greater through increased productive rate than through faster growth rate. In the present study, a total of 574 ewes joined with rams out of which 46,167,228,124 and 9 ewes had zero,one,two three and four lambings over two successive years (Figure 2).

The overall mean of LI was estimated for Harri ewes which had more than one lambing (374 ewes) and was found to be 243 days (about 8 months) (Table 4), indicating the possibility of accelerating lambing frequency for Harri sheep providing good management and feeding were available. Both month of lambing and year had a highly significant effect on LI. Ewes lambing in February and March had the least LI compared to other months. These results indicate that, like other fertility traits, LI is highly affected by environmental factors and improving the latter could give a wide scope for the improvement of this trait.

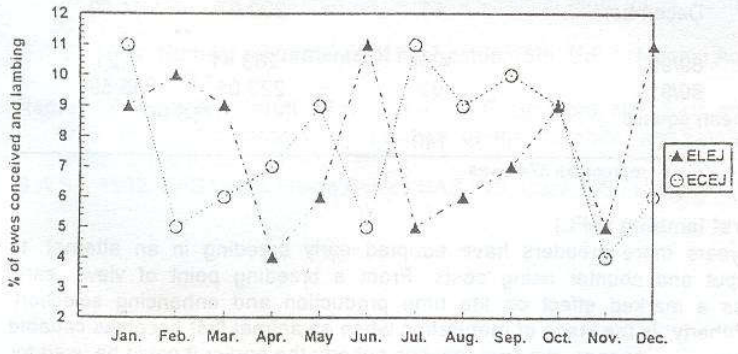

Figure 1. The incidence of lambing and expected incidence of conception

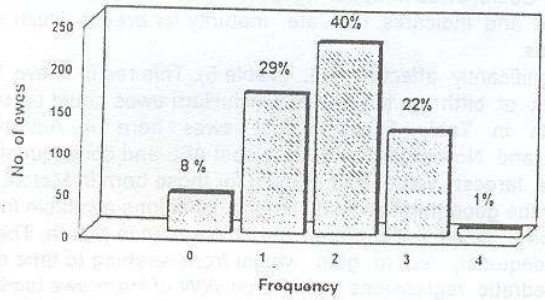

Figure 2. Frequency of lambing per two years

Table 4. Least squares means and standard error (SE) for lambing interval.

Classification	No.	Lambing interval (days) X	S.E.
Overall mean	527[1]	243.21	5.70
Month of lambing		**	
January	49	229.37	13.41
February	74	208.05	13.59
March	33	206.80	21.48
April	11	278.66	32.73
May	34	248.37	13.91
June	52	269.97	11.78
July	26	251.38	14.80
August	24	236.87	17.86
September	50	279.59	12.43
October	70	256.24	10.36
November	39	230.25	13.39
December	56	222.97	11.50
Year		**	
89/90	434	263.41	7.21
90/91	93	223.01	13.59
Residual mean square		1756.95	
Residual df	140		

** P< 0.01 1 represents 374 ewes

Age at first lambing (AFL)

In recent years more breeders have adopted early breeding in an attempt to increase output and counter rising costs. From a breeding point of view, early breeding has a marked effect on life time production and enhancing selection programs. Puberty is the stage of maturation when an animal first becomes capable of reproducing. The sooner the ewe reaches puberty the earlier it could be used for breeding. Table 5 shows that AFL was found to be 530.19 days (17.7 month). Assuming that average gestation length is nearly 150 days, the average age at puberty, therefore, for Harri ewes would be 380.2 days. Younis *et al.*(1972) have reported puberty in Ebeidi ewes in upper Egypt to be 387.4 days which is very close to the present value and indicates the late maturity for breeds which were raised under harsh conditions.

Month of birth significantly affected AFL (Table 5). This result shows the relative importance of month of birth on the age at which Harri ewes could be successfully first mated. Results in Table 5 show that ewes born in Autumn months (September,October and November) had the least AFL and consequently the least age at puberty. The largest value (678.9)being for those born in March. This result may be explained by the good nutrition and climatic conditions available for Harri ewe lambs born in Autumn months compared with those born in March. Therefore,ewe lambs should be adequately fed to gain weight from weaning to time of breeding. Both linear and quadratic regressions of AFL on WW of Harri ewe lambs were not significant (Table 5).

Table 5. Least squares means and standard errors (SE) for age at first lambing (days).

Classification	No.	$\bar{X}$	SE
Overall mean	25	530.19	27.33
Month of birth		**	
March	6	678.91	45.90
September	8	459.12	39.47
October	9	474.20	40.76
November	2	508.55	66.84
Reg. on WW		NS	
Linear		24.19	13.59
Quadratic		2.79	3.45
Residual means squares		8864.27	
Residual df		19	

WW, weaning weight of ewe , NS non significant , ** P< 0.01

CONCLUSION

The question which arises from the present study is that whether it is preferable to breed Harri sheep continuously along the year or to set up a certain breeding system?. The answer depends on many factors, among which the relative importance of continuous supply of produced lambs all over the year. If this is required the extra value of continuos production of lambs should outweigh the extra production costs and this system may be recommended, otherwise a system of 3 lambings per 2 years may offer a reasonable substitute.

Under continuous breeding conditions though on the average an ewe was able to produce one lamb per year , about 28.6% of the lambed ewes were able to have more than two lambings during the same period which may open a scope for selection for this trait (frequent lambing) in local breeds.

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الأداء التناسلى والإنتاجى للأغنام الحرى المرباة على مدار السنة تحت الظروف القاحلة

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أجريت الدراسة الحالية لتقييم أداء النعاج الحرى المرباة طوال العام مع الكباش تحت الظروف القاحلة فى المملكة العربية السعودية ، وتم تقدير مقاييس مختلفة لإنتاجية النعجة (عدد الحملان المولودة للنعجة الوالدة ، عدد الحملان المفطومة للنعجة الوالدة ، عدد الكيلوجرامات المولودة للنعجة الوالدة و عدد الكيلوجرامات المفطومة للنعجة الوالدة). بالإضافة إلى تحليل الصفات التناسلية للنعجة (الفترة بين ولادتين والعمر عند أول ولادة). وتضمنت البيانات الإنتاجية ١٠٣١ سجل ولادة مأخوذة من ٥٢٨ نعجة خلال سنتين متتاليتين وكانت عدد سجلات الولادة المتاحة لدراسة الفترة بين ولادتين ٥٢٧ سجل ولادة، بينما تم تقدير العمر عند أول ولادة على ٢٥ نعجة فقط. وكان متوسط الفترة بين الولادتين ٢٤٣,٢ يوما ومتوسط العمر عند أول ولادة ٥٣٠,٢ يوم. وتم تحليل ١١٣٢ سجل لأوزان الحملان عند الميلاد و ٨٩٩ سجل لأوزان الحملان عند الفطام لدراسة تأثيرات السنة ، شهر الولادة و الجنس على تلك الصفات.

أظهر شهر الولادة تأثيراً معنوياً على الكيلوجرامات من الحملان المفطومة للنعجة الوالدة وعلى الفترة بين الولادتين بينما تأثر العمر عند أول ولادة معنوياً بشهر الميلاد للنعجة. وأظهرت الدراسة أن معظم الولادات وبالتالى الحملان المولودة كانت من شهر ديسمبر إلى شهر مارس وذلك بالنسبة لكل النعاج الداخلة فى التلقيح وكانت أعلى كيلوجرامات من الحملان المفطومة للنعجة الوالدة فى مايو ويونيه. كما أظهرت جميع العوامل المدروسة (السنة ، شهر الولادة والجنس) تأثيراً معنوياً على صفتى وزن الميلاد والفطام للحملان.