ASSESSMENT OF THE REPRODUCTIVE PERFORMANCE OF A FLOCK OF DJALLONKÉ SHEEP BRED IN A HUMID FOREST ENVIRONMENT

P.K. Karikari, MSc
P. Gyawu, M.Ag, Sci, PhD
K. Asare, DVM, DTVM
E.L.K. Osafo, MSc, PhD.
Faculty of Agriculture, University of Science and Technology, Ghana.

ABSTRACT

The reproductive performance of a flock of Djallonké sheep reared in a humid forest environment is reported. Parameters considered in the study included postpartum anoestrous interval (PPAI), lambing interval (LI), conception weight, body condition score at lambing, lambing weight, litter weight at birth and litter weights at 2 and 3 months of age and litter weight gains at 2 and 3 months of age.

The correlation matrix of quantitative variables showed that LI and PPAI were highly correlated (r=0.94). Lambing interval and PPAI were not, however, significantly related to any of the other quantitative variables. The parameters measured for the lambs (litter weight at birth and weights at 2 and 3 months of age and weight gains at 2 and 3 months of age) were highly inter-related. The weight of the ewes at conception was also strongly correlated with their weight at lambing (r=0.93).

Analysis of variance carried out on PPAI and LI separately using month, season and parity as categorical variables failed to show that PPAI and LI were affected significantly by any of the variables (P>0.05). However, it was shown that LI was significantly shorter in ewes lambing in September-October compared to those which lambed in November-March (P<0.05) and July-August (P<0.01). The relatively poor performance of ewes lambing during the November-March period may be due to inadequate feed resources as the period is dry. Shorter grazing periods and high worm loads during the rainy season may explain the poor performance recorded at the end of the major rainy season (July-August).

The ewes had a mean (±S.E.) prolificacy of 1.32±0.04. The mean (±S.E.) annual reproductive rate (lambs/year) was 1.9±0.1 while the mean body condition score was 2. The lamb mortality rate at 3 months of age was 17%. It was concluded that the Djallonké sheep could be a real asset to the resource-poor farmers in Ghana due to their high reproductive ability even when their body condition was poor.

KEYWORDS: *Djallonké, sheep, lambing interval, anoestrus, Ghana.*

INTRODUCTION

The sheep population in Ghana is mainly made up of the Djallonké breed. The breed is small [1], but hardy and suitable for the harsh conditions in which it is normally reared. Many resource-poor farmers in Ghana keep small flocks of sheep. Many workers in urban areas also keep sheep in their backyard to supplement their incomes. It is anticipated that the Djallonké breed will form the basis of any serious sheep breeding programmes in Ghana. Unfortunately, very little research has been done on the reproductive traits of the Djallonké in Ghana. This study was, therefore, conducted to assess the reproductive performance of a flock of Djallonké sheep on an institutional farm in the humid forest zone of Ghana.

MATERIALS AND METHODS

Reproductive traits of Djallonké ewes in the humid forest zone of Ghana were studied. Factors influencing PPAI and LI were studied with respect to the following variables: parity of ewe, the month of lambing, season of lambing, lambing weight, body condition score at lambing, conception weight, litter weight at birth, litter weights at 2 and 3 months of age, and litter weight gains at 2 and 3 months of age. The study was carried out at the Dairy/Beef Cattle Research Station of the University of Science and Technology (U.S.T.) in Kumasi, Ghana. The area has a bimodal rainfall pattern: March-July and September-October. August is relatively dry but the main dry season starts from November to February. Mean annual rainfall is about 1300 mm while daily temperatures average 26°C. Relative humidity varies from 97% in the wet season to as low as 20% during the dry season.

Plasma progesterone levels were used to determine the length of PPAI. Blood samples were taken twice a week from postparturient ewes, starting a week after lambing and ending when ewes were judged to have resumed ovarian activity postpartum. Samples were centrifuged to obtain plasma which was used to determine the blood progesterone level. Plasma was stored at -20°C until assayed for progesterone using

P.K. Karikari

P. Gyawu

K. Asare

E.L.K. Osafo

the FAO/IAEA progesterone radioimmunoassay kit [2]. The intra- and inter- assay coefficients of variation were 6.2% and 8.4%, respectively. Postparturient ewes having progesterone levels $\geq$2nmol l^{-1} in three or more consecutive samples were deemed to have started ovarian activity.

Ewes and their lambs were weighed within 24h of lambing and then once every month. The body condition of ewes was scored at lambing and also during the monthly weighings on a scale of 0-5, zero being the minimum and 5 the maximum on the scale [3]. The ewes were housed in the night and were provided with water ad libitum. The sheep were grazed from about 08:00h to about 15:00h daily on a 60ha open field. They, however, grazed shorter hours if it rained in the morning as shepherds delayed in sending them to the field. Lambs were weaned naturally at about 3-4 months of age. Males ran with females throughout the year.

Annual reproductive rate in this study was defined as: (365 x Prolificacy x 1-mortality rate)/lambing interval. In the statistical analyses, PPAI and LI were used separately as dependent variables. The general linear models approach was adopted in studying the relationships between PPAI and LI with respect to the independent variables. The SYSTAT statistical package [4] was used for the analyses.

RESULTS

As a preliminary step, the correlations between all pairs of quantitative variables were investigated. The correlation matrix is shown in Table 1. The PPAI was almost perfectly linearly correlated with LI (r = 0.94). However, PPAI and LI were not related to any of the other quantitative factors investigated. None of the models that contained quantitative variables (such as conception weight, litter weight, etc.) as independent variables were of good fit when PPAI and LI were used as dependent (response) variables. Fig.1 shows the effect of month of lambing on LI. Ewes which lambed in September-October had statistically shorter LI than those which lambed in November-March ($P<0.05$) and July-August ($P<0.01$). Ewes which lambed in April-June also outperformed those which lambed in July-August ($P<0.01$). Postpartum

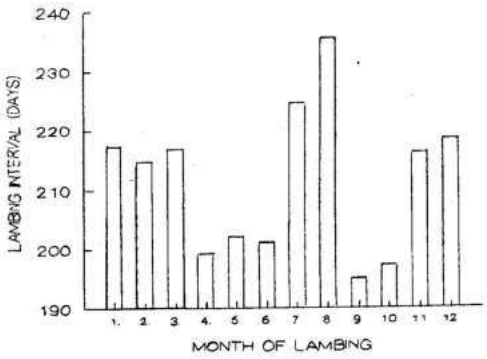

Fig. 1: The Effect of Month of Lambing on Lambing Interval

TABLE 1. CORRELATION MATRIX OF QUANTITATIVE VARIABLES USED IN THE STUDY*.

	WL	LBW	LW2	LW3	LG2
Weight at lambing (WL)	1.000				
Litter birth weight (LBW)	0.391	1.000			
Litter weight at 2 months (LW2)	0.460	0.855	1.000		
Litter weight at 3 months (LW3)	0.496	0.861	0.968	1.000	
Litter weight gain at 2 months (LG2)	0.451	0.708	0.970	0.927	1.000
Litter weight gain at 3 months (LG3)	0.500	0.765	0.948	0.986	0.943
Conception weight (CW)	0.929	0.296	0.346	0.394	0.340
Lambing-conception gain (LCG)	-0.242	-0.271	-0.325	-0.295	-0.315
Postpartum anoestrous interval(PPAI)	-0.149	-0.244	-0.199	-0.176	-0.155
Lambing interval (LI)	-0.088	-0.226	-0.192	-0.176	-0.159
	LG3	CW	LCG	PPAI	LI
Litter weight gain at 3 months (LG3)	1.000				
Conception weight (CW)	0.402	1.000			
Lambing-conception gain (LCG)	-0.285	0.134	1.000		
Postpartum anoestrous interval(PPAI)	-0.143	-0.202	-0.130	1.000	
Lambing interval (LI)	-0.149	-0.137	-0.123	0.944	1.000

*The least r value for significance at 5% level = 0.40

Table 2. Some reproductive data on Djallonké sheep according to season of lambing.

	MEAN ± S.E. Parameter	
	Wet season (March-October)	Dry season (November-February)
Lambing interval (d)	212.2 ± 3.5(26)+	217.1 ± 3.9(48)
Postpartum anoestrous interval (PPAI) (d)	67.5 ± 5.0(26)	66.5 ± 3.7(48)
Weight at lambing (kg)	23.5 ± 0.6(26)	22.9 ± 0.5(48)
Condition score at lambing	2.0 ± 0.05(26)	2.1 ± 0.04(48)
Weight at conception(kg)	23.8 ± 0.6(26)	22.5 ± 0.4(48)
Prolificacy	1.33 ± 0.1(26)	1.31 ± 0.1(48)
Annual reproductive rate	1.94 ± 0.09(26)	1.85 ± 0.09(48)
Litter weight at birth(kg)	2.7 ± 0.2(25)	.6 ± 0.1(41)
Litter weight at 2 months(kg)	8.9 ± 0.6(23)	9.0 ± 0.5(41)
Litter weight at 3 months(kg)	10.8 ± 0.8(23)	11.4 ± 0.6(39)

+Figure in brackets denotes number of observations

anoestrous interval was also longest in ewes lambing in August (113d) compared to the others (range:50-73d).

Lambing interval was significantly ($P<0.01$) influenced by the duration of PPAI, giving a regression equation:

$$LI = 139.3 + 1.2 \times PPAI.$$

Means of some reproductive data on the ewes recorded according to the season in which they lambed are presented in Table 2. The mean (±S.E.) LI and mean (±S.E.) prolificacy were 214.6±2.62d and 1.32±0.04, respectively. The mean (±S.E) annual reproductive rate (lambs per year) was 1.9±0.1. Lambs averaged 2.0±0.1 kg at birth. They gained 82.6±3.0 g per day during the first 2 months of life, but the average daily weight gain was 73.4±2.3 g at the age of 3 months. Ewes were in poor to average body condition at the time of lambing; the condition scores ranged from 1.5 to 2.5 with a mean of 2. The ewes lambed throughout the year, but forty six percent of the lambings coincided with the dry season (November-February).

DISCUSSION

The high correlations between the weight of the ewe at lambing and litter weight at birth, litter weights at 2 and 3 months of age and litter weight gains at 2 and 3 months were expected since multiple births occur more in heavier (and often older) ewes while smaller females are more likely to give birth to single lambs.

The present data suggest that the reproductive performance of Djallonké sheep in the humid forest zone of Ghana depends on the period of year when ewes lamb. This is supportive of findings reported elsewhere in Africa [5, 6]. However, as reported by Kabuga and Akowuah [7], the traditional wet and dry seasons failed to show any significant effect on PPAI and LI. The present data (Fig.1) suggest that the lack of seasonal effect may be due to the fact that the effect of the dry season (November-February) spills over to the month immediately following it (March) and the fact that the performance of ewes was exceptionally poor at the later stages of the major rainy season (July-August). The relatively poor performance exhibited by ewes lambing in July-August may be the result of inadequate nutrition due to shorter grazing periods, and high helminthiasis infestation during the period. Working in the same zone, Asare and Wilson [8] reported that the peak of worm infestation in the Djallonké coincided with the rainy season. Dick [9] also found that Djallonké sheep in the zone lost weight during the period June-August. The lambing interval (214.6±2.62d) recorded for the present flock falls within the range of 191-294d reported for the Djallonké by Payne [1]. It is also similar to the 226.5±12d reported for the same breed reared under village conditions in the humid forest zone of Ghana [9]. The lambing interval recorded in the present study was shorter than the 271-307d reported by some earlier workers [8, 10, 11, 12] for the breed. The mean prolificacy of 1.32±0.04 and annual reproductive rate of 1.9±0.1 compare favourably with earlier results which ranged respectively from 1.12 to 1.31 and 1.33 to 1.81 [8, 9, 10, 11, 13, 14]. The study, therefore, shows that even Djallonké ewes with poor body condition can be prolific. The Djallonké breed, therefore, seems very appropriate for the resource-poor farmers who may not be able to feed their sheep well.

The daily growth rate of 73.4±2.3 g up to 3 months of age is similar to the 72-76 g reported by earlier workers [10, 11, 15]. The Sahelian sheep, which is also available in Ghana, has a mean prolificacy ranging from 1.02-1.08 and a mean reproductive rate of between 1.36 and 1.45 [12, 16], but it is bigger (35-65 kg) than the Djallonké (21-26 kg) [13]. Consequently, the Sahelian x Djallonké crossbred has a higher birth weight [7] than the Djallonké (2.7 kg vrs 2.0 kg). Crossing the Djallonké ewe with the Sahelian ram could therefore be used to combine the good reproductive performance of the Djallonké ewe and the bigger size of the Sahelian ram to enhance mutton production in Ghana. The high correlations between litter weight at birth and live-weight changes up to 3 months suggest that it may not be necessary to take weight measurements of lambs for long periods in evaluating ewe reproductive performance or even in selecting lambs for breeding purposes.

Assuming a gestation period of 150 days, it is realized that the ewes generally conceived at first oestrus postpartum. This suggests that fertility is no problem in the Djallonké sheep. It therefore means that as suggested by the regression equation:

$$LI = 139.3 + 1.2 \times PPAI$$

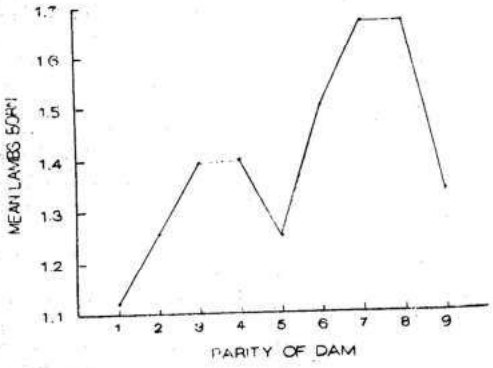

Fig. 2: Parity Effect on Number of Lambs Born

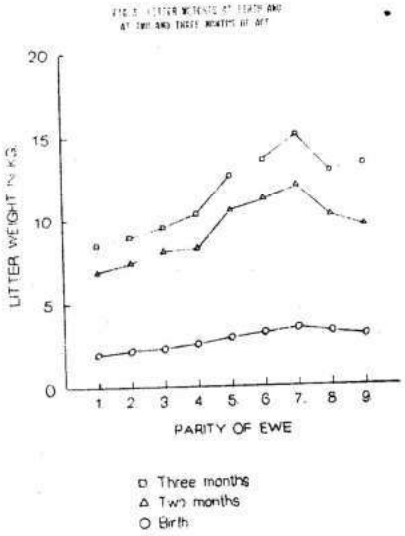

Fig. 3: Litter Weights at Birth and at Two and Half Months of Age

,the PPAI is crucial in determining lambing intervals in the breed. Fig.2 shows that ewes are more likely to give birth to twins as they advance in parity (and in age). Consequently, litter weights at birth and at 2 and 3 months of age were higher in ewes in advanced parity (Fig.3). Sulieman *et al.* [6] have also reported that birth weights increased linearly with parity in station-born lambs in the Sudan. The present study, however, presents some evidence (Figs.2 and 3) to suggest that reproductive performance may decline after the seventh parity. This means that it may not be a good management practice to retain very old ewes. The superior performance shown by ewes lambing in April-June and September-October confirms earlier reports that some periods are more favourable to fertilization than others [5, 17, 18, 19].

CONCLUSION

The study has established PPAI as the main determinant of LI. Even though the Djallonké ewes used in the study were not in good body condition their reproductive performance was good. This suggests that the breed could be of benefit to the resource-poor farmers who may not have the capacity to feed their sheep well. A crossbreeding of the Djallonké ewe with the Sahelian ram is, however, suggested to enhance mutton production in Ghana.

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