BALAMI SHEEP: PERFORMANCE IN NORTH-EASTERN NIGERIA

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ABSTRACT

Balami sheep is the largest indigenous breeds of sheep in Nigeria with a mature ewe weight of 43 kg. The performance of this breed was studied using 454 lambing records of 142 ewes during a 6-year period. Lambing occurred throughout the year with a peak during the wet season. First lambing was at 18 months of age and subsequent lambings occurred at approximately 9 months intervals. Means litter size increased from 1.02 at first lambing to 1.6 at 54 months years of age. Lambing interval was shorter by 50 days for lambings in the wet than in the dry season. Lamb mortality to 10 weeks of age was about 43%. Lambs born during the wet season, those from primiparous ewes and twins had low survival rates. Mean birth weight was 3.3kg and weights at 4 and 10 weeks of age were 7.4 and 12.1kg respectively. Type of birth, age of dam and sex had significant effects on weights at all ages. Productivity of ewes estimated as weight of weaned lamb per annum or as weight of weaned lamb per kg metabolic weight of ewe per annum increased with the age of ewe to about 55 months of age. Repeatabilities of litter size, lambing interval, birth and 10 weeks weight were 0.087, 0.091, 0.052 and 0.273 respectively.

Key words: Balami sheep, performance, north-eastern Nigeria.

INTRODUCTION

The Balami sheep of Nigeria are found in the North-Eastern part of the country where the vegetation is of the Sahelo-Sudan Savanna type (Adu and Ngere, 1979a). In this area of sparse vegetation, this breed shows a remarkable ability to live and produce. Indeed, their adaptability to this harsh environment is so marked that they decline in body condition and production when raised in areas with higher rainfall such as the Guinea Savanna zones.

Information on the performance of this breed in its natural environment is fragmentary. This paper presents estimates of phenotypic

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MATERIALS AND METHODS

A general description of the Balami breed has been given by Adu and Ngere (1979a). The material for this study was drawn from the Marguba Livestock Improvement and Breeding Centre situated in Borno State. Marguba is situated 60km from Maiduguri which is located at 11.8° latitude north and 13.1° longitude east. Mean maximum temperature range from 35 to 42°C. The average annual rainfall is about 63mm, most of which precipitates during June to September.

Ewes were maintained on grasses which consisted mostly of *Aristida adscensionis*, *Cenchrus biflorus*, *Andropogon gayanus* and *Pennisetum pedicellatum*. Supplementary concentrates were offered during the dry season.

Matings occurred throughout the year with ram: ewe ratio of about 1:20. Lambs were weaned at variable periods after birth but not before they were 10 weeks of age.

The information used in the present study compares data of 454 lambing records of 142 ewes obtained during the period 1972 - 1977. Weight records of lambs were not available for all lambs born. Birth weight information was obtained for 271 lambs while data on weights at later ages were even fewer because of mortality or failure to record weights.

The traits studied were litter size, lambing interval, birth weight, 4-week and 10-week weights of lambs and lamb mortality to 10 weeks of age. Least squares analyses (Harvey, 1960) were carried out for all the traits studied. For analyses of reproductive traits, constants were fitted for year, season of lambing and dam-age, while in the analyses of weight data, constants were also

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fitted for type of birth and sex in addition to those mentioned above. Mortality was scored as 1 or 0, those surviving receiving a score of 1 and those not surviving a score of 0.

Type of birth was classified into single or twin and age of dam into five groups; group 1 (below 18 months or age), group 2 (19-30) months, group 3 (31-42 months), group 4 (43-54 months) and group 5 (over 55 months). Season was classified into dry, wet and post-wet season corresponding to the months of February-May, June-September and October-January respectively. The post-wet season corresponds to the "harmattan" when both temperature and humidity are low.

Repeatabilities were determined for litter size, birth weight and 10-week weight. The coefficient of repeatability was defined as the ratio of the between sheep variance to the combined sheep plus residual variance after removing environmental effects (Turner and Young 1969).

RESULTS AND DISCUSSION

Lambing occurred throughout the year (Fig. 1) but there was a seasonal trend with about 45% of the lambings occurring during the wet season (June-September) and only 27% during the dry season (February-May).

Fig. 1. Lambings during the months of the year.

Reproductive traits

The mean age at first lambing determined from least squares analysis after adjusting for effects due to year and season of birth was $18.6 \pm$

0.5 months. Subsequent lambings occurred at approximately 9 months intervals, the mean ages at the second, third, fourth, fifth and sixth parities being 27.2, 35.5, 43.9, 52.9 and 55.8 months respectively.

The least squares means of litter size and lambing interval are shown in Table 2. Litter size increased rapidly from 1.20 at 18 months of age to a maximum of approximately 1.6 lambs at 54 months and declined slowly as animals grew older. This relationship of age of dam to litter size is different from the pattern observed in exotic breeds such as the Merino (Turner and Dolling, 1965) or in the Marsham (Newton and Fenlon, 1979) where litter size increased with age up to about 7 years.

Lambing interval is an important characteristic of tropical sheep that lamb throughout the year than it is for temperate types which breed seasonally. In the latter breeds, it is the number of lambs per lambing that has the greatest influence on reproductive efficiency. On the other hand, in tropical breeds, reproductive efficiency as measured by the number of lambs weaned per ewe per annum is equally influenced by lambing interval as by litter size. However, as the mortality associated with twin lambs is often much greater than in singles, the increment in reproductive efficiency due to a reduction in lambing interval is greater than through an equivalent increase in litter size.

This can be illustrated by a numerical example. The number of lambs weaned per ewe/annum, $N = \frac{2LS_1}{Y_1} + \frac{(1-L)s_2}{Y_2}$

Where

N = number of lambs weaned/annum/ewe
L = proportion of twin lambings

S_1 = survival rate of twins

s_2 = survival rate of singles

Y_1 = lambing interval in years after twin birth

Y_2 = lambing interval in years after single birth.

The values obtained in this study for L, S_1 , S_2 , Y_1 , Y_2 were 0.29, 0.50, 0.63, 0.81 and 0.73 respectively. Using these parameters, $N = 0.968$. If L was increased by 10% to 0.319, N would increase only marginally by 1% to 0.978. On the other hand, if lambing interval was decreased by 10% so that

Y_1 and Y_2 were 0.730 and 0.658 years, N would increase by about 10% to 1.075. The mean lambing interval over all lambings was 282 days. Season and type of birth had significant effects on lambing interval (Table 1). Lambings occur-

Figure 2. Relationship between month of lambing and subsequent month of conception.

ing during the wet season had the shorter subsequent lambing interval (258 days) while those of the dry season were about 50 days longer. The seasonal variation is most likely due to nutritional changes that follows the rainfall pattern. This is illustrated in Fig. 2 which shows the

relationship between month of lambing and month of subsequent conception. The latter was arrived at by deducting 150 days from the lambing interval. The short period to conception of lambing during June-September is clearly evident.

TABLE 1: LEAST SQUARE MEANS (LSM) OF LITTER SIZE, LAMBING INTERVAL AND LAMB MORTALITY

Sub class	Litter size		Lambing intervalp (days)		Lambing mortality (%)	
	No.	LSM*	No.	LMS	No.	LSM
Overall mean	451	1.29	307	282.0	213	43.6
Season						
Wet	200	1.28	+ 55	258.5 ^a	101	62.9 ^a
Post-wet	133	1.29	87	280.0 ^{ab}	48	36.3 ^b
Dry	118	1.28	65	307.5 ^b	64	31.6 ^b
Dam age						
1	69	1.02 ^a	64	296.3 ^a	12	81.6 ^a
2	180	1.10 ^{ab}	133	283.9 ^a	82	45.6 ^b
3	113	1.29 ^b	78	289.5 ^a	67	31.1 ^b
4	56	1.59 ^c	24	289.0 ^a	36	31.4 ^b
5	33	1.44 ^c	8	251.3 ^a	16	28.3 ^b
Type of birth						
Single	-	-	243	267.0 ^a	144	37.2 ^a
Twin	-	-	64	297.0 ^b	69	50.0 ^b

*Value within each subclass with different superscripts differ significantly ($P < 0.05$)

The advantage of a short lambing interval following lambings during the wet season does not necessarily imply a superior reproductive performance of ewes lambing in this season. The effect of period of lambing on future performance was examined by determining the number of

lambings following lambing during a particular season. The mean number of lambings over a two-year period for ewes lambing in the wet, post-wet and dry season were 2.79, 2.72 and 2.73

TABLE 2: LAMB MORTALITY BIRTH WEIGHT

	Birth weight (kg)					
	2.5	2.6-3.0	3.1-3.5	3.6-4.0	4.1-4.5	4.6
No. born	16	29	44	86	83	13
No. dead	10	15	20	30	22	1
Mortality (%)	62.5	51.7	45.4	41.9	26.5	7.7

respectively indicating that the superiority of wet season lambing was only very slight.

Twin lambings resulted in a lambing interval of about one month longer than single lambings probably due to the greater stress on the dam consequent to the larger quantity of milk required for twins.

Lamb Mortality

Lamb mortality estimates were based on only 213 lambs as records of other lambs were not available. Mortality was high in this flock, averaging 43.6%. It was significantly influenced by season, age of dam and type of birth (Table 2). Lambs born during the wet season had the poorest chance of survival which is most probably due to adverse weather conditions. Similar results have also been reported for other breeds

TABLE 3: LEAST SQUARES MEANS (LSM) OF LAMB WEIGHTS (KG)

Subclass	Birth weight		4.-week weight		10.-week weight	
	No.	LSM	No.	LSM	No.	LSM
Overall mean	271	3.34	240	7.45	184	12.15
Season						
Wet	123	3.31 ^a	105	6.71 ^a	86	10.84 ^a
Post-Wet	67	3.24 ^a	58	7.52 ^{ab}	41	12.47 ^{ab}
Dry	81	3.47 ^a	77	8.12 ^b	57	12.46 ^b
Damage						
1	12	2.29 ^a	11	5.86 ^a	98	9.04
2	91	3.21 ^b	75	7.52 ^b	63	11.58 ^b
3	89	3.55 ^b	85	8.09 ^c	69	13.10 ^b
4	53	33.64 ^b	47	8.05 ^c	29	12.96 ^b
5	26	3.62 ^b	22	7.72 ^b	15	14.16 ^c
Type						
Single	143	3.67 ^a	129	8.46 ^a	99	13.51 ^a
Twin	128	3.01 ^b	111	6.44 ^b	85	10.79 ^b
Male	141	3.47 ^a	123	7.77 ^a	95	12.67 ^a
Female	130	3.21 ^b	111	7.13 ^b	89	11.63 ^b

*Values within each subclass with different superscripts differ significantly ($P < 0.05$)

Figure 3. Relationship between weight of dam, age of dam and litter size at birth.

of sheep in other locations in Nigeria (Adu, Brinckman & Kuteyi, 1979b; Taiwo, 1980). The major cause of the age of dam effect on lamb survival was the difference between ewes lambing for the first time at 18 - 24 months of age and older ewes. As reported by other workers (Bichard and Cooper, 1966), lamb mortality declines with maternal age, perhaps due to superior pre-natal and post-natal environment of older ewes. Twin lambs did not survive as well as single lambs, but the advantage of twinning was not completely lost, since the survival rate of the twin lambs was not less than half that of the single lambs.

Birth weight had a marked influence on lamb mortality. Mortality decreased as birth weight increased from about 1.8kg to 4.6kg or more (Table 2). Lambs that were close to the mean weight of 3.3kg had mortality rates of 40-45%, while the heaviest lambs had lowest mortality. This is contrary to the reports of Mullaney (1969) for Merinos, and Young (1964) for Welsh Mountain sheep. These workers observed maximum survival at a birth weight just above the mean, but observe a decline in survival as birth weight increased further. The discrepancy is probably due to the very low incidence of dystocia in the Balami, since dystocia was adduced as a possible explanation for increased mortality at high birth weights in the Merino and Welsh Mountain breeds.

Weights:

The mean birth weight of 3.3kg for Balami lambs is higher than that of other indigenous breeds of Nigeria (Buvanendra, Adu and Oyejola, 1981). Type of birth was the most important factor influencing birth weight, accounting for about 18% of the total variation. The difference in weights between singles and twins which was about 20% of the weight of twins at birth increased to about 25-30% at 4-10 weeks of age indicating that the maternal milk supply was inadequate to maintain growth rate of twin lambs at level comparable to that of singles.

Maternal age accounted for about 8% of the variation in birth weight and was next in importance to type of birth. The obvious effect of age of dam was the markedly smaller birth weights of lambs from 18 - 30 months old ewes compared to older animals. Since it was observed earlier that the lightest lambs had the lowest chance of survival, the poor survival rate of lambs from young ewes is probably related to birth weight.

Lambs from 18 - 30 months old ewes were the slowest growing at 4 and 10

weeks of age while the highest lamb growth to 4 weeks was sustained by 36 - 48 months old ewes (Table 3). This is probably a reflection of the high milk yield of ewes of this age group since the correlation between milk yield and lamb growth to 4 weeks is high (Glover, 1971). However, at 10 weeks, while lambs from the youngest ewe group were still the lightest, lambs from oldest group (over 54 months) were heaviest, outgrow-

ing lambs from 36 - 48 months old ewes. This is perhaps due to a superior persistency of lactation in the older ewes.

Season of birth was not an important source of variation in weight at birth. However, seasonal effects were significant for weights at 4 and 10 weeks of age (Table 3), the most obvious difference being between dry and wet season lambs. Dry season lambs were consistently heavier than wet season lambs, the post-wet season lambs being intermediate. Since the post-natal nutritional level of the ewe and hence its milk yield is likely to be optimal during the wet season (when pasture growth is maximal), the low growth rate of the lambs may be ascribed to the adverse weather conditions and other associated problems such as parasitism.

Male lambs had significantly heavier birth weights than female lambs. This advantage of the male lambs was also observed at 4 and 10 weeks of age.

Adult weights of ewes were estimated for a single weighing done during May 1979 of animals of various ages. Stepwise polynomial regressions were fitted and the equation that gave the best fit was $Y = 11.8 X - 0.00556 X^2$ ($R^2 = 0.793$) where Y and X represent weight (kg) and age (months) respectively. The mature weight was 43kg which was attained at about 60 months of age.

The measure of ewe productivity that is important economically is the weight of weaned lamb per ewe (P). This is a complex trait that involves litter size at birth (s), mortality rate to weaning (m) and weight of weaned lamb (b). The relationship of these traits to P is expressed by

$$P = sb(1-m).$$

When relating this measure of productivity to ewes of different ages, weight of ewe (w) should be considered, since it is known that feed requirements are related to metabolic weight ($W^{0.75}$). Then, the adjusted value of productivity (P') is

$$P' = sb(1-m)/W^{0.75}.$$

The changes in P and P' with age of ewe are shown in Fig. 3. P increased progressively with age of ewe, while P' reached its peak value at 48 months after which it declined slightly.

Repeatability

The repeatability of litter size at first lambing obtained by the regression of the number of

TABLE 4: REPEATABILITY OF LITTER SIZE, LAMBING INTERVAL AND LAMB WEIGHTS.

Trait	Ewe D.F.	Repeatability
Litter size	85	0.087 $\pm$ 0.036
Lambing interval	85	0.091 $\pm$ 0.063
Birth weight	69	0.052 $\pm$ 0.037
10 - week weight	31	0.0272 $\pm$ 0.150

lambs at first parity on the mean of the second and fourth records was only 0.016. However, the second lambing record had a higher repeatability of 0.16 (Table 4) and was therefore a better predictor of future lambing performance. Purser (1965) also reported that the repeatability (from first to second lambings was significantly lower than that for consecutive lambings) at older ages. The overall repeatability of litter size obtained by weighing the repeatability estimates of first, second and third lambing records by the inverse of their variances was 0.087 ± 0.036 . This value is lower than most previous estimates. The reason given by Adu, Buvanendran and Lakpini (1979c) to explain the negative repeatability estimate for litter size in Nigerian goats, which was that animals bearing twins were unable to recover from the strain of twinning due to inadequacies in nutrition, also explains the present result.

The repeatability of lambing interval (Table 4) was low indicating that permanent differences between ewes accounted for only a small amount of variation in this trait. Though estimates for repeatability of lambing interval are not common in literature, repeatability estimates of calving interval in cattle in the tropics are also low.

The repeatability of birth weight was very low (Table 4) but that for 10 weeks weight was 0.27. The latter estimate is close to that of the Yankasa breed in Nigeria (Buvanendran *et al.*, 1981).

In conclusion, Balami sheep, though not very prolific in terms of number of lambs born per lambing, have a moderately high productive rate per annum when its litter size of 1.3 is considered in conjunction with its capacity to lamb every nine and half months. However, the full potential of this reproductive capacity is not realised due to the high lamb mortality. Improvement of survival rate requires more attention to husbandry conditions such as provision of shelter and minimising parasitic infections, particularly during the rainy season. The growth rate of lambs to 10 weeks of age to maturity is greater than those of other indigenous breeds of Nigeria. There was

no indication that the use of older ewes reduced the output of the flock. They proved as capable as the younger ewes in producing heavy litter weights. Although litter size declined slightly in the older ewes, the increased post-natal survival rate and superior lamb growth more than compensated for the loss in litter size.

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