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Growth and Reproductive Performance of the Indigenous Sheep of Nigeria Reared in a Humid Tropical Environment

Lawrence BRATTE
Department of Animal Science, Delta State University, Asaba Campus, Asaba, Nigeria
E-mail of the corresponding author: lbratte@yahoo.com

Abstract
In a study to determine the growth and reproductive performances of sheep from the arid and semi-arid north of Nigeria (the Yankasa (Y), Ouda (U) and Balami (B)) the West African Dwarf (W) sheep as well as YxW and BxW crosses in a hot, humid tropical environment, adult Yankasa (Y) sheep (3 rams and 7 ewes), Ouda (U) (2 rams and 1 ewe) and Balami (B) (2 rams and 2 ewes) sheep acquired from various locations in northern Nigeria were introduced into the experimental location at Ile-Ife, southwest Nigeria. The sheep, together with West African Dwarf (W) sheep (2 rams, 5 ewes), 11 YxW and 3 BxW crossbred ewes were kept in complete confinement for 24 months, and stall-fed with fresh forage (*Panicum maximum, Gliricidia sepium* and *Leucaena leucocephala*) and a concentrate diet. Data collected included ewe body weights, average daily gains (ADG) (in gd^{-1}) and all lambing records. Within-season comparisons of the average daily gains (ADG) revealed significant genotype differences, with higher gains occurring in the Balami x West African Dwarf crossbred (B x W) and Ouda (U) ewes than in the other genotypes at the first early and late rainy season (April-September). All genotypes lost weight during the dry season (October – March), with the greatest losses occurring in the BxW, YxW and U ewes. Average number of lambs born per ewe per year depended on genotype, and was higher in the W and BxW (1.50 each) and lowest in the purebred genotypes from the north of Nigeria: Y (0.67), B (0.5) and U (0.5). Lambs from the Y, B and U had significantly higher birth weights (2.39 – 2.95kg) than the W (1.87kg) and the Y x W (1.91kg) lambs. Y, W and YxW ram lambs born as singles were heavier at birth than their ewe-lamb counterparts. Lambs born as twins and triplets generally had lower birthweights than those born as singles. Percent multiple births ranged from 25.00 to 47.83% and was highest in the YxW ewes. Lambing interval ranged from 255.18d in the West African dwarf (W) sheep to 402.67d in the Yankasa. Percent lamb mortality from birth to 180d was higher in the Balami (50.00%), the YxW (56.52%) and BxW (44.44%) than in the other genotypes. Litter size per ewe was lowest in the northern purebred genotypes (Y, B and U) than in the W and its crossbred progenies with the Y and B. It was concluded that although lambs from the B, YxW and BxW ewes were most susceptible to the vagaries of climate, and had higher mortalities than the Y, U and W, the similarity between these sheep and the W ewes in lambing performance suggests that sheep from the drier northern regions of Nigeria can, with better management and feeding, be reared to reproduce successfully in the rainforest zone of Nigeria.
Keywords: Nigerian sheep, reproductive performance, season, lamb, tropics, genotype

1. Introduction

About 80% of Nigeria's sheep can be found in the drier agro-climatic zones of the country (Osinowo, 1992) where rainfall is low and limited to only about three or four months in the year, grasses are abundant but of low quality, and water supply for livestock is available in only a few scattered water points across the region. The indigenous sheep genotypes of the north of Nigeria, already described by Adu and Ngere (1979) and Ugwu (2007), are the Yankasa, Ouda and Balami. Although these genotypes generally have heavier birth and adult weights, and grow faster than the West African Dwarf sheep which thrive best in the lower fringes of the Derived Savanah, and in the rainforest regions of southern Nigeria (Ugwu, 2007), their productivity is severely limited by the semi-arid and arid environments in which they live.

On account of its higher precipitation, the rainforest zone of southern Nigeria has the potential for more abundant crop and forage production and water supply (Ademosun, 1988), and for livestock production through provision of more succulent forages and browses, root and tuber products and drinking water all year round. The predominant sheep breed in this zone is the West African Dwarf sheep which is widely believed to be trypanotolerant, and well adapted to the rainforest environment. It is a slow-growing breed with smaller birth and adult weights when compared with the northern breeds of Nigeria's sheep.

Given the higher growth potentials of the Yankasa, Balami and Ouda sheep, and the greater potential of the wetter rainforest zone of Nigeria to support the production of more abundant succulent herbage for most of the year, introducing the breeds into the more humid south should normally improve overall productivity of sheep in Nigeria. However, as noted by Buvanendran and Adu (1990) on survival of Balami sheep outside its traditional arid location in northeast Nigeria, the northern sheep exhibit very low survival rates, and decline in body condition and productivity when introduced to the rainforest zone of Nigeria.

Is it possible, with better management, to keep Yankasa, Ouda and Balami sheep in the rainforest agro-

climatic zone of Nigeria? This study set out to determine the growth and reproductive performances of Yankasa (Y), Ouda (U), Balami (B) and West African Dwarf (W) sheep, and some of their crosses kept in complete confinement for 24 months in a humid tropical environment.

2. Materials and Methods

Ten adult Yankasa (Y) sheep (3 rams and 7 ewes) procured from the National Animal Production Research Institute, Shika, Zaria in Nigeria, 3 Ouda (U) (2 rams and 1 ewe) and 4 Balami (B) (2 rams and 2 ewes) sheep acquired from various sheep markets in northern Nigeria were introduced into the experimental location at Ile-Ife, southwest Nigeria. Ile-Ife is in the rainforest agro-climatic zone of Nigeria, on longitude 4° 69'E and latitude 70° 50′ N, has an annual rainfall of 1000-1250mm (Oguntoyibo, 1982; Badejo *et al.*, 2011), and a mean annual temperature of about 27^{o}C.

The sheep were quarantined for a month, during which they received prophylactic doses of an antibiotic (5 mL oxytetracycline per animal daily for 4 days, IM) and an anthelminth (10 mL per animal of oxfendazole, as Systamex ® from Coopers Animal Health, UK).

At the end of quarantine, the sheep that survived were weighed, tagged for identification and transferred to pens on basis of genotype. These sheep, together with an existing flock of 7 West African Dwarf (W) sheep (2 rams, 5 ewes), 11 YxW crossbred ewes and 3 BxW crossbred ewes, constituted the experimental animals. Each sheep pen had dwarf walls of about a metre in height, and a raised floor made from whole or split bamboo slats to reduce accumulation of faecal materials in the sheep pens. Each pen was provided a forage rack, concentrate feeders and water troughs.

The sheep ware kept in complete confinement, and stall-fed with fresh forages (*Panicum maximum, Gliricidia sepium* and *Leucaena leucocephala*) and a concentrate diet formulated with Brewers' Dried Grains, rice bran, palm kernel cake and a mineral/vitamin premix. Drinking water was made available *ad libitum*.

Data collected over the 24-month period included all lambing records and ewe body weights. Average daily gains (ADG) (in gd^{-1}) were computed for the genotypes. ADG and lamb birth weights for the genotypes were compared by the one-way analysis of variance (ANOVA) procedure using IBM's SPSS statistical package (v20 of 2011). The Duncan's multiple range procedure of the same statistical package was employed to separate significantly different means.

3. Results and Discussion

Variations in mean body weight gains of the different sheep genotypes in the late rainy season (July – September), early dry season (October – December), late dry season (January – March) and early dry season (April – June) are shown in Table 1. Within-season comparisons of the average daily gains (ADG) revealed that there were significantly ($P<0.05$) higher gains in the Balami x West African Dwarf crossbred (BxW) and Ouda (U) ewes than in the other genotypes at the first early rainy season (April-June) when herbage was most available. ADG increased tremendously in all the genotypes up to the late rainy season (July to September). In these seasons, gains recorded in the West African Dwarf and Yankasa x West African Dwarf ewes were significantly ($P<0.05$) lower than those of the other genotypes thus confirming that breed and season are indeed important determinants of performance in sheep (Buvanendran and Adu, 1990; Gbangboche *et al.* 2006; Koycegiz *et al.* 2009). With the advent of the first early dry season (October to December), AGD declined drastically and varied significantly with breed, with weight losses recorded for the W and YxW ewes, but not for the Y, B, U and BxW. All the sheep lost weight during the first late dry season (January – March), with the greatest losses occurring in the BxW, YxW and U ewes. While it is known that seasonal variations in rainfall determine forage availability and quality which, in turn, impact on the nutrition and growth of livestock (Regassa *et al*., 2006), the crossbred progenies between the West African Dwarf and the Yankasa, and the purebred Ouda from the very arid Sahelian savannah of northeast Nigeria were most adversely affected. ADG during the 2nd early rainy season also varied with breed, and was higher ($P<0.05$) in the B x W than in any of the other genotypes. ADG in the W and U sheep were similar and positive but significantly ($P<0.05$) higher than for YxW, B and Y sheep. During the 2nd dry season, the W and BxW ewes were the genotypes most adversely affected by the absence of water and reduced quality of forages.

Table 1: Within-season variations in average daily body weight gain (ADG) (g/d) between the indigenous sheep of Nigeria and some of their crosses

Genotype	1st early rainy season April-June	1st late rainy season July-September	1st early dry season October-December	1st late dry season January-March	2nd early rainy season April-June	2nd late rainy season July-September	2nd early dry season October-December	2nd late dry season January-March
Yankasa(Y)	25.79 ±5.39^{b} (6)	65.46 ±10.02^{ab} (6)	10.04 ±8.42^{a} (6)	-21.85 ±4.23^{a} (6)	-0.01 ±0.01^{c} (6)	-5.79 ±2.26^{c} (6)	4.08 ±1.73^{b} (6)	13.10 ±8.48^{b} (6)
Balami (B)	10.99 ±1.17^{c} (4)	78.31 ±8.06^{ab} (4)	17.35 ±9.08^{a} (4)	-22.85 ±6.32^{a} (4)	0.01 ±0.00^{c} (4)	5.06 ±1.60^{b} (4)	-9.69 ±1.32^{b} (4)	22.32 ±7.10^{a} (4)
Ouda (U)	27.11 ±2.69^{b} (3)	105.49 ±19.54^{a} (3)	15.64 ±5.57^{a} (3)	-58.52 ±1.48^{ab} (3)	8.68 ±2.64^{b} (3)	0.10 ±0.00^{c} (3)	-30.61 ±5.10^{c} (3)	11.05 ±3.77^{b} (3)
WAD (W)	11.46 ±1.02^{c} (7)	57.61 ±18.19^{b} (7)	-8.89 ±2.14^{b} (7)	-23.81 ±2.02^{a} (7)	7.15 ±4.87^{b} (7)	12.07 ±9.04^{a} (7)	-21.14 ±5.64^{c} (7)	-11.19 ±7.79^{c} (7)
Y x W	11.84 ±4.92^{c} (11)	53.85 ±16.88^{b} (11)	-19.41 ±4.71^{a} (10)	-59.39 ±11.16^{ab} (9)	-3.06 ±1.20^{c} (9)	-0.79 ±0.08^{c} (9)	13.85 ±7.93^{a} (9)	-7.94 ±2.60^{c} (9)
B x W	45.42 ±6.00^{a} (3)	87.18 ±5.13^{a} (3)	18.37 ±4.71^{a} (3)	-111.85 ±23.53^{c} (3)	19.39 ±1.02^{a} (3)	11.51 ±9.97^{a} (3)	-28.23 ±2.42^{c} (3)	-7.94 ±2.60^{c} (3)

$^{a, b, c}$ Means within the same column with the same superscript do not differ significantly (P>0.05). Each figure in parentheses is number of animals.

Table 2 is a summary of the lambing and lamb birth weight records of the various sheep genotypes during the two-year period. Average number of lambs born per ewe per year was higher in the W and BxW (1.50 each), followed by the YxW (1.05), and lowest in the purebred genotypes from the north of Nigeria: Y (0.67), B (0.5) and U (0.5), as was also the percent lambing rate per year. These values suggest that the W and its crosses with the B and Y were better adapted to the rainforest region of southern Nigeria for reproduction than their northern counterparts (Y, B and U). Lambs from the Y, B and U had significantly (P<0.05) higher birth weights (2.39 – 2.95kg) than the W (1.87kg) and the YxW (1.91kg) lambs. Birthweights for the Y, B and U obtained in this study were, however, lower than those reported for these genotypes (2.9-3.2kg, 3.1-3.5kg and 3.0-3.8kg respectively) by Adu and Ngere (1979), which may, again, be a reflection of the poor level of adaptability of the northern sheep to the rainforest zone. Y, W and YxW ram lambs born as singles were heavier at birth than their ewe-lamb counterparts (2.69 vs 2.25kg respectively for Y, 2.20 vs 2.03kg respectively for W, and 2.19 vs 2.10kg respectively for the YxW). Lambs born as twins and triplets generally had lower birthweights than those born as singles. Percent multiple births ranged from 25.00 to 47.83% and was highest in the YxW ewes, as was also the 0-180-day lamb mortality.

Table 2: Lambing, lamb birth weight and lamb mortality records of the Nigerian indigenous sheep and some of their crosses with the West African dwarf sheep

	Indigenous Sheep Genotypes					
Parameters	Yankasa (Y)	Balami (B)	Ouda (U)	West African Dwarf (W)	Y x W	B x W
Number of ewes	6	2	1	5	11	3
Number of rams	4	2	2	2	4Y	2B
Number of lambs born	8	2	2	15	23	9
Male	4	-	-	6	18	6
Male single	3	-	-	2	10	4
Male twin	1	-	-	4	8	2
Female	4	2	2	9	5	3
Female single	3	2	2	7	2	1
Female twin	1	-	-	2	3	2
Single	6	2	2	9	12	5
Twin	2	-	-	6	8	4
Triplet	-	-	-	-	3	-
No. of lambs born/ewe/year	0.67	0.50	0.50	1.50	1.05	1.50
Mean lamb birth weight (kg)	2.39±0.39^{ab}	2.95±0.42^{a}	2.60±0.23^{a}	1.87±0.11^{c}	1.91±0.51^{c}	2.26±0.60^{ab}
Single male (kg)	2.69	2.95	2.60	2.20	2.19	2.33
Single female (kg)	2.25	0.00	0.00	2.03	2.10	2.60
Twin male (kg)	2.20	2.95	2.60	1.53	1.57	2.1
Twin female (kg)	2.20	0.00	0.00	1.70	1.93	2.1
Triplet male (kg)	0.00	0.00	0.00	0.00	1.20	0.00
Triplet female (kg)	0.00	0.00	0.00	0.00	1.50	0.00
Lambing rate/year (%)	66.67	50.00	50.00	150.00	104.55	150.00
Multiple births (%)	25.00	0.00	0.00	25.00	47.83	44.44
Mean lambing interval (days)	402.67	0.00	0.00	255.18	323.50	294.00
Average litter size	1.14	1.00	1.00	1.25	1.35	1.29
Lamb mortality (0-180d) (%)	25.00	50.00	0.00	26.67	56.52	44.44

$^{a, b, c}$: Within a row, means with different superscripts differ significantly (P<0.05)

Although production of multiple births in sheep is often accompanied by lower lamb birthweights and reduced survival rates (Galal *et al*., 1981) as was also observed in this study, birthweights recorded for the YxW twin lambs were higher than those of the W lambs (Table 2) and therefore may not account for the relatively higher lamb mortality observed in the YxW crossbred sheep. Morbidity records (not shown in the table) of the lambs born in this study indicated that these lambs, which were born from crosses between YxW ewes and Y rams, were the most susceptible to infections of all the lambs produced in this study. The Yankasa is native to the drier Guinea and Sudan savannah of the middle belt regions of Nigeria, and they, as well as the Balami and Ouda which thrive well in the more arid regions of northern Nigeria, are reported to have low survival rates in the humid south of Nigeria (Buvanendran and Adu, 1990). This may not be unconnected with the fact that the hot, humid tropical environment of southern Nigeria enhances the proliferation of pathogens and parasites which drastically reduces the productive and reproductive capacity of poorly adapted livestock species (Chiejina, 2001; Chiezey *et al*., 2008).

Lambing interval ranged from 255.18d in the West African dwarf (W) sheep to 402.67d in the Yankasa. The mean lambing interval of 257.95 days (range, 191-344d) reported for the W sheep by DAGRIS (2005) closely agrees with that obtained for the breed in this study, and with an earlier value of 221d (range, 119-256d) reported by Steinbach (1980). However, lambing interval for Yankasa ewes in this study (402.67d) was much higher than the value of 253.1±2.9d reported for the breed in Zaria, Nigeria (the Yankasa's traditional location) by Awemu *et al*. (2000).

Percent lamb mortality from birth to 180d was higher in the Balami (50.00%), the YxW (56.52%) and BxW (44.44%) than in the other genotypes. Litter size per ewe was lowest in the northern purebred genotypes (Y, B and U) than in the W and its crossbred progenies with the Y and B.

5. Conclusion

It can be concluded therefore that although lambs of the Balami, Yankasa x West African Dwarf and Balami x West African dwarf ewes were, in this study, most susceptible to the vagaries of climate, and had higher mortalities than the Y, U and W, the similarity between their dams and the W ewes in lamb birth weights, % lambing rate per year, % multiple births, lambing intervals, average litter size and number of lambs born per ewe

per year suggests that sheep from the drier northern regions of Nigeria (the Yankasa, Balami and Ouda sheep) can, with better management and feeding, be reared to reproduce successfully in the rainforest zone of Nigeria.

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