Trop. Anim. Prod. Invest. 29 (01):10-16(2026)
ISSN: 1115-2540
https://journals.ui.edu.ng/index.php/tapi

ORIGINAL RESEARCH ARTICLE

Growth Performance of Three Nigeria Sheep as Influenced by Sex and Breed

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ABSTRACT

The study aimed to evaluate the growth performance of three Nigerian sheep as influenced by sex and breed. A total of eighteen (18) growing (12 – 18 months) sheep comprising three rams and three ewes each of Balami, Uda and Yankasa breed were purchased from National Veterinary Research Institute (NVRI) Vom. The experimental sheep were balanced for weight and allotted into six treatments based on breed (Balami, Uda and Yankasa) and sex (rams and ewes) effects with three replicates in a 2×3 factorial arrangement. The sheep were fed a total mixed ration comprised of 14.77% crude protein for 90 days. The results indicated a significant ($P<0.05$) effect of sex and breed on the sheep's weight gain and voluntary feed intake. The rams had higher ($P<0.05$) weight gain and feed intake than the ewes while among the three breeds, Balami recorded the highest ($P<0.05$) weight gain and feed intake, followed by Uda while Yankasa had the least weight gain and feed intake, although, the efficiency of feed utilization was neither affected by sex nor by breed effect. In conclusion, rams and Balami breed of sheep exhibited improved weight gain compared to ewes and Uda and Yankasa sheep. It can be recommended that for optimal growth performance rams and Balami breed of sheep should be used.

Keywords: Breed, Growth performance, Sex and Sheep

INTRODUCTION

Growth performance of sheep is influenced by breed, type of birth, sex, age or parity of the dam, month or season of parturition, disease incidence and management practices such as mortality, nutrition and husbandry practice (Hassan *et al*., 1990; Osinowo *et al.,* 1994 and Hassan 2014). Average daily gain of 103, 96 and 70 g was reported for Uda, Yankasa and crossbred lambs respectively during the pre-weaning stage. At post weaning, daily gain of Uda and Yankasa were 51 and 53 g respectively. Aruwayo *et al*. (2007) and Muhammad *et al*. (2008) reported ADG of 109 and 80 g/day respectively for Uda lambs after weaning. Growth rate can be influenced by a combination of factors which include management system, season of the year and physiological state of the animal (Ogebe, *et al.,* 1985). Live weight, when measured under standard conditions, can provide a useful index of muscle growth. The relationship between live weight and muscle or protein content of the body can be distorted by variation in gut fill, the weight, as well as the condition and moisture content of the fleece. Muscle comprises a remarkably constant proportion of the fleece free empty body weight, even in association with considerable variation in fatness. The proportion of viscera, inedible offal and bone varies inversely with the fat content of the body.

Sex plays a significant role in growth, reproductive traits, and feed efficiency. Male sheep (rams) across all three breeds grow faster, have higher feed intake, and reach market weight earlier than females. They also tend to have more developed musculature and better dressing percentage (Akpa *et al*., 2019). Females (ewes) are smaller, with more body fat and lower muscle mass. They are valued more for reproduction than for meat. Nutritional needs for breeding females are higher during late gestation and lactation (Yakubu and Akinyemi, 2017). In Yankasa, rams mature faster and show more aggressive feeding behavior than ewes, especially under competition (Okpeku *et al.,* 2020). In Balami, rams grow larger and more muscular due to breed characteristics. Ewes are also prolific, but they need better nutritional care due to their larger size (Akpa *et al*., 2019). In Uda, sexual dimorphism is more pronounced. Rams have a bolder appearance with prominent horns and longer legs. Despite their smaller size, Uda ewes are tough and highly adapted to marginal environments (Yakubu and Akinyemi, 2017).

The nutritional limitation, low nutritive value of the range, high ambient temperature, scarcity of feed and water has great effect on the reproduction and production performance of the sheep (Idris *et al.,* 2010; Ebrahiem *et al*., 2015). Generally, animals reared on natural pastures produce meat and skins that vary in physical characteristics and

chemical constituents when compared to animals raised in closed and semi closed systems or feed lots. These differences may be due chiefly to breeds and seasons variations especially in feedstuff matter quality (Ebrahiem *et al*., 2015). The aim was to evaluate the growth performance of three Nigeria sheep as influenced by sex and breed.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Small Ruminant Unit of the Teaching and Research Farm of the Federal College of Animal Health Production Technology, Vom, Plateau State and Animal Products and Processing Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State. Vom is located on Latitude 9.73 N, longitude 08.79 E at an altitude of 1,280m above sea level, along Jos-Manchok Road in the Northern Guinea Savannah Zone of Nigeria (Ovimap, 2023). The climate is characterized by a tropical wet and dry season. Wet season starts from April to early May and ends in late September to early October while dry season lasts from October to April. The total annual rainfall ranges from 1200 – 1500 mm with a long-term average of 1350mm. Maximum air temperature of 30^0C are recorded in March-April and minimum sit temperature of 10^0C recorded in December/January and relative humidity of approximately 80% during the rainy season (NiMet, 2023).

Experimental animal and experimental design

A total of eighteen (18) young (12 – 18 months) intact sheep compromising of Balami, Uda and Yankasa (three rams and three ewes) were purchased from Small Ruminant Unit of Teaching and Research Farm of the Federal College of Animal Health and Production Technology, Vom. The sheep were distributed into three (3) treatments based on breed (Balami, Uda and Yankasa) and sex (rams and ewes) each treatment was replicated six (6) times in a Completely Randomized design. The sheep were tagged and kept in a pen equipped with watering and feeding facilities based on their sexes throughout the ninety-day feeding trials.

Management and feeding

The animals were given prophylactic treatment and quarantined for two weeks before the commencement of the experiment and were dewormed with Albendazole 10% 3ml/20kg orally sprayed with Ammeter (Acaricide) 20ml/15 liter of water, injected with Oxytetracycline LA 1ml/10kg (im), Tylosine LA 1ml/10kg (im)and ivermectin 1ml/50kg (SC). The sheep were also given intramuscular application of oxytetracycline and B complex at the dosage of 1 ml/10kg body weight. A complete diet was formulated using modified Pearson square method and was done after proximate analysis was conducted to determine protein content of the protein source. For other ingredients, values from literature were used. After the formulation of complete diets, proximate analysis was carried out to determine the proximate composition of the diet. A daily allowance of complete diet at the rate of 4% body weight per head was offered. Fresh and clean water was given *ad-libitum*. The diet was formulated to contain 15% crude protein (CP) content (Table 1).

Table 1: Growth composition of experimental diets fed to growing sheep

Ingredients	**Composition (%)**
Groundnut shell	40.00
Maize Offal	14.00
Cotton seed cake	44.00
Bone meal	1.25
Salt	0.50
Total	100.00
Calculated Analysis	
Crude protein	15.00
Metabolizable energy (Kcal/kg)	2349.00
Laboratory Analysis	
Dry matter	97.31
Crude protein	14.77
Neutral detergent fibre	14.66
Acid detergent fibre	2.64

Daily feed intake was taken throughout the experiment by weighing the feed offered each day and left over (orts) in the following day. Daily intake of the diets was estimated for each animal by subtracting the leftover from the quantity served to the animal. Daily water intake and ambient temperature of the environment was recorded. The experiment lasted for 90 days. Weight of the animal was measured at the onset of the trial after an overnight fasting to obtain their initial weight and subsequently at 2 weeks interval between 8:009:00 am throughout the feeding trial. Weight gain was determined by subtracting the initial weight from final weight within the periods. Feed conversion ratio was also determined by dividing feed intake by weight gain.

Chemical Analysis

The feed samples were analysed for proximate analysis and fibre fractions using AOAC (2005) and Van Soest *et al*. (1991) at the Biochemistry Laboratory of National Animal Veterinary Research Institute, Vom, Plateau state.

Statistical Analyses and Models

All data collected were subjected to analysis of variance (ANOVA) of SAS Package (2005) while significant treatment means were separated using the Duncan's Multiple Range Test (Duncan, 1955).

Model:

$Y_{ijk} = \mu + T_i + B_j + (A*B)_{ij} + E_{ilk}$

Where: Y_{ijk} = is the record of observations for dependent variables

μ= is the population mean

A_i = effect of breeds (i = Balami, Uda and Yankasa)

B_j = effect of sex (j = Ram and Ewe)

$(A*B)_{ij}$= effect of interaction between breeds and sex

E_{ijk} = random error assumed to be normally and independently distributed with zero means and standard variation.

RESULTS AND DISCUSSION

Main effects of sex on growth performance of three Nigerian sheep breed fed total mixed ration

The growth performance of three Nigerian sheep fed total mixed ration as influenced by sex is presented in Table 2. There was significant ($P<0.05$) effect of sex on the final body weight, average daily weight gain, average daily feed intake and dry matter intake. Higher ($P<0.05$) final body weight (29.76 kg), average daily weight gain (120.00 g/day), average daily feed intake (1082.33 g/day) and dry matter intake (974.33 g/day) were obtained for rams compared to the lower final body weight (26.06 kg), average daily weight gain (100.00 g/day), average daily feed intake (958.67 g/day) and dry matter intake (862.67 g/day) observed for ewes. There was non-significant ($P>0.05$) effect of sex recorded for initial body weight and feed conversion. The initial body weight ranged from 17.06 kg for ewes to 18.96 kg for rams while feed conversion ratio ranged from 8.40 for rams to 8.66 for ewes.

The observed sexual dimorphism, where rams outperform ewes in growth traits, is a well-documented phenomenon in sheep and other livestock species. This pattern is primarily attributed to underlying physiological and endocrinological differences (Owens *et al*., 1993). The significantly higher average daily gain (ADG) and final body weight in rams recorded in this study align with numerous studies on tropical sheep breeds. Afolayan *et al*. (2006) reported higher weaning weights and growth rates for rams compared to ewes. Similarly, intact rams possess greater potential for muscle deposition and overall growth (RIM, 1992). This could be due to the anabolic effects of androgenic hormones like testosterone, which promote nitrogen retention and protein synthesis (Sejian *et al*., 2019). The ewes' lower growth rate may also be influenced by the onset of sexual maturity and the energetic demands of the estrous cycle, which can partition nutrients away from somatic growth (Gatemby and Humbert, 1991). The higher average daily feed intake and dry matter intake in rams are majorly responsible for their higher weight gains, since larger body size and a faster metabolic rate necessitate greater nutrient intake to sustain the higher rate of gain (NRC, 2007). Animals' physiological demand for energy and protein influence feed intake. The most intriguing finding is the non-significant difference in feed conversion ratio (FCR) is surprising because FCR is a measure of biological efficiency, indicating the amount of feed required to produce a unit of gain. The results show that despite consuming more feed and growing faster, the rams were just as efficient as the ewes at converting feed into tissue accretion. This suggests that the superior performance of the rams was not achieved at the expense of feed efficiency. This finding disagrees with the report of Owens *et al*. (1993) who reported that rams convert feed more than ewes due to their higher proportion of lean tissue growth. The non-significant difference for FCR as observed in this study could imply that the diet provided sufficient nutrients for both sexes to optimize their growth potential with similar efficiency. A similar non-significant effect of sex on FCR was reported by Tsegay *et al*. (2013) in their study of indigenous Ethiopian sheep fed a basal diet of natural pasture hay.

Main effect of breed on growth performance of three Nigerian sheep fed total mixed ration

Table 3 illustrates the growth performance of three Nigerian sheep fed total mixed ration as influenced by breed. There was significant ($P<0.05$) effect of breed on the final body weight, average daily weight gain, average daily feed intake and dry matter intake.

Table 2: Main effects of sex on growth performance of three Nigerian sheep breed fed total mixed ration

Parameters	Ram	Ewe	SEM
Initial body weight (kg)	18.96	17.06	0.97^{NS}
Final body weight (kg)	29.76^{a}	26.06^{b}	0.97*
Av. daily wt gain (g/day)	120.00^{a}	100.00^{b}	1.00*
Av. daily feed intake (g/day)	1082.33^{a}	958.67^{b}	3.45*
Dry matter intake (g/day)	974.33^{a}	862.67^{b}	2.95*
Feed conversion ration	8.40	8.66	0.41^{NS}

^{ab}Means within rows with different superscripts differed significantly ($P<0.05$), SEM = Standard error of mean, NS= non-significant

There was higher (P<0.05) final body weight (29.21 kg) obtained in Balami breed which was statistically similar with that of Uda breed (27.95 kg) but higher (P<0.05) than the final body weight (26.56 kg) recorded for Yankasa breed. Also, higher (P<0.05) average daily weight gain (120.00 g/day), average daily feed intake (1058.50 g/day) and dry matter intake (952.50 g/day) were noted in Balami breed, followed by that of Uda breed (110.00, 1022.00 and 920.00 g/day,) while the least (P<0.05) mean values for average daily weight gain (100.00 g/day), average daily feed intake (981.00 g/day) and dry matter intake (883.00 g/day) were recorded in Yankasa breed. However, there was non-significant (P>0.05) effect of breed for initial body weight and feed conversion. The initial body weight ranged from 17.58 kg for Yankasa breed to 18.41 kg for Balami breed while feed conversion ratio ranged from 7.96 for Balami breed to 8.87 for Yankasa breed.

The superior performance of the Balami breed aligns with its description as the largest native sheep breed in Nigeria. Foundational work by Adu and Ngere (1979) identified Balami as a fastest growing breed than the other breeds. This genetic predisposition for larger body size and rapid growth is the primary driver for its higher final weight and ADG observed in this study. A recent study by Madziga *et al*. (2025) and Madziga *et al*. (2022) directly corroborates these findings, reporting that Balami sheep presented higher total weight gain than the Uda breed and performed better than the Yankasa breed. The genetic basis for this superior growth in Balami sheep is further supported by research into growth-related genes, such as the Insulin-like Growth Factor (IGF) family, which play a crucial role in muscle development and body weight. The Uda breed's intermediate performance also reflects its established characteristics as a large, long-legged breed adapted to extensive grazing in the Sahelo-Sudan zone but its performance can be more variable, particularly when removed from its adapted environment. The study by Ayanniyi *et al*. (2024) found that while Uda rams performed well, their final body weight and feed conversion ratio were not as favourable as those of Balami rams in a fattening programme. The Yankasa breed, while widely distributed and noted for its superior reproductive performance, is intermediate in size between the larger Uda/Balami and the smaller West African Dwarf sheep (Adu and Ngere, 1979). Consequently, its lower growth rate and final weight in the provided results are expected. The pattern of feed intake (both ADFI and DMI) directly reflects the growth potential and body size requirements of the breeds. This positive correlation between body weight, growth potential, and voluntary feed intake is a fundamental principle in ruminant nutrition (NRC, 2007). The non-significant difference in FCR is a critical finding demonstrating that while the breeds grew at different rates, they were all statistically similar in their biological efficiency at converting feed into live weight. This suggests that the observed differences in growth are primarily a function of differences in mature size and its associated drive to consume more feed, rather than inherent differences in metabolic efficiency. This result is mirrored in the study by Madziga *et al*. (2022), which explicitly states that while Balami sheep performed better, there was no difference in the efficiency of feed utilization between the breeds.

Interaction effect between breed and sex on growth performance of three Nigerian sheep fed total mixed ration

The growth performance of three Nigerian sheep fed total mixed ration as influenced by breed and sex is tabulated in Table 4. There was significant (P<0.05) effect of sex and breeds on the weight gain and feed intake. The initial weight for rams of Balami (19.38 kg) Uda (19.00 kg) and Yankasa (18.50 kg) were statistically similar. Also, the ewes of Balami (17.44 kg) and Uda (17.10 kg) were similar but lower (P<0.05) than Balami ram while Yankasa ewe (16.65 kg) recorded the least significant mean for initial weight which was at par with Uda ewe. Higher (P<0.05) final body weight was recorded for Balami ram (31.08 kg) which was similar with Uda ram (29.80 kg), followed by Yankasa ram (28.40 kg) which was at par with Uda ram and Balami ewe (27.34 kg).

Table 3: Main effect of breed on growth performance of three Nigerian sheep fed total mixed ration

Parameters	Balami	Uda	Yankasa	SEM
Initial body weight (kg)	18.41	18.05	17.58	0.97^{NS}
Final body weight (kg)	29.21^{a}	27.95^{ab}	26.56^{b}	0.97*
Av. daily wt gain (g/day)	120.00^{a}	110.00^{b}	100.00^{c}	1.05*
Av. daily feed intake (g/day)	1058.50^{a}	1022.00^{b}	981.00^{c}	3.55*
Dry matter intake (g/day)	952.50^{a}	920.00^{b}	883.00^{c}	2.85*
Feed conversion ration	7.96	8.39	8.87	0.46^{NS}

^{ab}Means within rows with different superscripts differed significantly (P<0.05), SEM = Standard error of mean, NS = non-significant

Table 4: Interaction effect between breed and sex on growth performance of three Nigerian sheep fed total mixed ration

Parameters	Balami		Uda		Yankasa		SEM
	Ram	Ewe	Ram	Ewe	Ram	Ewe	
Initial body wt (kg)	19.38^{a}	17.44^{b}	19.00^{ab}	17.10^{bc}	18.50^{ab}	16.65^{c}	0.90*
Final body wt (kg)	31.08^{a}	27.34^{bc}	29.80^{ab}	26.10^{cd}	28.40^{b}	24.75^{d}	0.89*
Av. daily wt gain (g/day)	130.00^{a}	110.00^{c}	120.00^{b}	100.00^{d}	110.00^{c}	90.00^{e}	0.99*
Av. daily feed intake (g/day)	1121.00^{a}	996.00^{d}	1084.00^{b}	960.00^{e}	1042.00^{c}	920.00^{f}	7.51*
Dry matter intake (g/day)	1009.00^{a}	896.00^{d}	976.00^{b}	864.00^{e}	938.00^{c}	828.00^{f}	6.70*
Feed conversion ratio	7.76	8.15	8.13	8.64	8.53	9.20	1.52^{NS}

^{abcdef}Means within rows with different superscripts differed significantly (P<0.05) using each sex SEM, SEM = Standard error of mean, NS = non-significant

Yankasa ewe (24.75 kg) recorded the least significant mean for final body weight which was at par with Uda ewe (26.10 kg). Average daily weight gain was higher (P<0.05) in Balami ram (130.00 g/day) compared to Balami ewe, Uda and Yankasa sheep while the least (P<0.05) average daily weight gain was recorded in Yankasa ewe (90.00 g/day). Similar trends were observed with average daily feed intake and dry matter intake. However, there was non-significant (P>0.05) effect of sex and breed on feed conversion ratio of the three examined Nigerian sheep fed total mixed ration. The significant effect (P<0.05) of sex and breed which revealed higher final body weight on Balami similar to Uda suggests that Balami and Uda have superior growth potential under the given dietary conditions, possibly due to genetic predispositions for weight gain (Bawa *et al*., 2021). It was observed for average daily weight gain that this trend mirrors final body weight results, reinforcing Balami's efficiency in converting feed to body mass. The consistent male advantage across breeds highlights the role of sex hormones, such as testosterone, in promoting muscle development and growth (Osinowo *et al*., 2020). The higher intake in Balami and Uda likely contributed to their superior growth, as increased nutrient availability supports metabolic processes and tissue accretion (Iyayi *et al*., 2019).

Feed conversion ratio (FCR) as a measure of feed efficiency showed no significant (P>0.05) differences based on sex or breed. This implies that while Balami and Uda sheep consumed more feed and gained more weight, their efficiency in converting feed to body weight was statistically similar to Yankasa. This could indicate that the diets were equally utilized across breeds, with differences in growth stemming primarily from variations in intake rather than metabolic efficiency (Adua *et al*., 2021).

The findings emphasize the importance of breed selection and sex considerations in sheep production systems in Nigeria. Balami and Uda sheep, particularly males, demonstrate better growth performance under similar feeding regimes, making them preferable for meat production. However, the non-effective difference noted in FCR suggests that with optimized feeding strategies, Yankasa could also achieve competitive growth, potentially offering advantages in resource-limited settings due to lower feed intake.

The superior growth performance of Balami over Yankasa is consistently reported in the literature. Bawa *et al*. (2020) found similar results in a comparative slaughter study, attributing Balami's advantage to its selection history for size and meat production in arid regions. The intermediate position of Uda is also commonly reported. Some international studies on improved sheep breeds often find a positive genetic correlation between growth rate and feed efficiency (i.e., faster-growing animals are more efficient). The lack of such a correlation in this study may be specific to indigenous breeds on low-input, basal diets. Kosgey *et al*. (2006) noted that indigenous breeds often exhibit adaptation traits prioritized over maximum lean growth, which can result in different relationships between production traits. The consistent FCR suggests that, under the study conditions, none of the breeds or sexes had a distinct metabolic advantage in nutrient utilization for growth. The clear male advantage in growth performance is a universal finding, corroborated by extensive research, including work by Kadir *et al*. (2020) on pre-slaughter management, which identified sex as a major source of variation in live weight and carcass yield.

CONCLUSION AND RECOMMENDATION

The significant sex effect revealed that rams were superior to ewes in terms of growth performance. The significant breed effect indicated that Balami sheep had comparable performance indices as Uda but outperformed Yankasa in terms of growth performance. It is therefore recommended that for optimal growth performance rams should be preferred over ewes while Balami breed should be preferred over Uda and Yankasa.

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