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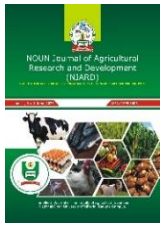

Original Article

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Effect of Some Factors on Carcass Traits of Nigerian Sheep Breeds

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ABSTRACT

This study assessed the influence of breed, sex, and location on carcass traits of Nigerian sheep (Yankasa, Uda, Balami).A total of 126 sheep were sourced from abattoirs in Gombe, Yobe, and Borno States. Carcass traits evaluated included hot carcass weight (HCW), neck weight (NW), shoulder weight (SHW), rack weight (RckW), breast weight (BrstW), leg weight (LgW), and loin weight (LnW). Data were analyzed using analysis of variance (ANOVA). The results showed clear effects of breed, sex, and location on carcass traits. Sheep from Borno State consistently exhibited higher values for most carcass parameters, followed by those from Yobe and Gombe. Among the breeds, Balami sheep outperformed Uda and Yankasa in nearly all measured traits across all locations. Males also showed higher carcass values than females within each breed. Notably, Balami rams from Borno State recorded the highest carcass weights across most traits, including HCW, NW, SHW, RckW, LgW, and LnW. In contrast, the lowest values were observed in Yankasa ewes from Gombe State. The findings highlight significant interactions between breed, sex, and location, emphasizing the importanceof considering these factors in sheep breeding and meat production strategies.

Keywords: *Carcass traits, Sheep, Location, Breed and Sex*

INTRODUCTION

Sheep play a critical role in the livelihoods and food security of rural households in Nigeria. As one of the most important small ruminant species in the country, they contribute significantly to income generation, meat production, and socio-cultural activities (Adeyemi*et al.*, 2021). Small ruminants, including sheep, account for approximately 63.7% of the total grazing domestic mammals in Nigeria (Akusu*et al.*, 2021), and their ability to survive and reproduce under harsh tropical conditions makes them a vital resource for sustainable livestock production (Oyeyemi*et al.*, 2020). According to the Food and Agriculture Organization (FAO, 2021), Nigeria's sheep population stood at around 27.2 million in 2020, with about 19.9 million located in the northern region of the country (Nigerianstat, 2019). In particular, Borno and Yobe States in the North-East account for 13.6% and 12.5% of the national sheep and goat populations, respectively.

Carcass traits, which refer to the measurable attributes of meat, fat, and bone in slaughtered animals, are central to

assessing meat quality and market value in sheep (Al-Atiyat*et al.*, 2021). Traits such as dressing percentage, carcass weight, muscle conformation, and fat deposition are key indicators of economic value in the meat production chain (Rodríguez-Sánchez *et al.*, 2020; Balcı*et al.*, 2021). Selection for superior carcass traits not only enhances production efficiency but also aligns with consumer preferences and industry standards (Kafkas &Yakan, 2021). Despite the importance of carcass characteristics in sheep breeding and meat production, there is limited data on how breed, sex, and location influence these traits in indigenous Nigerian sheep populations, particularly the Yankasa, Uda, and Balami breeds.

Therefore, this study aims to evaluate the effects of breed, sex, and geographical location on carcass traits in Yankasa, Uda, and Balami sheep of Northeastern Nigeria.

The central hypothesis is that breed, sex, and location have significant and predictable effects on these economically important traits.

MATERIALS AND METHODS

Description of Study Area

The data for this study was collected from three (3) states of Nigeria; Gombe, Yobe and Borno. The coordinate, altitude, annual rainfall, humidity and average temperature of the three states are presented in Table 1.

Table1: Description of the selected study area

State	Coordinates	Altitude (m)	Rainfall (mm)	Humidity (%)	Average environmental Temp. (°C)
Gombe	10°15'N 11° 10'E	461	680.45	42.12	30.54
Yobe	12°00'N 11° 30'E	373	443.92	33.02	36.29
Borno	11°30'N 13°00'E	353	693.97	30.00	37.00

N = North, E = East, m = meter, mm = millimeter, % = percent, °C = DegreeCelsius, °= degree, ' = minute

Experimental Animals and Management

A total of 126 matured sheep were used, comprising equal numbers (42 each) from the Yankasa, Uda, and Balami breeds. The animals, averaging two years of age (with two pairs of permanent incisors)were obtained from major slaughter facilities in the capital cities of Gombe, Yobe, and Borno States. In each location, 14 animals per breed were selected, ensuring a balance of seven males and seven females per groupto allow for the evaluation of sex-related variations in the measured trait.

Data Collection

A total of one hundred and twenty six(126) animals (fourty two each for Yankasa, Uda and Balami) were used. Slaughtering was carried out according to standard halal practices. Following exsanguination, the animals were skinned, and non-carcass components specifically the head, legs, and internal organs were removed. All carcass measurements were taken promptly, within an hour post-slaughter, to minimize potential weight loss due to moisture evaporation or tissue shrinkage.Seven (7) carcass traits were measured. These include; hot carcass weight (HCW), neck weight (NW), shoulder weight (SHW), rack weight (RckW), breast weight (BrW), leg weight (LgW) and loin weight (LnW). These parameters were attained using a digital weighing scale (METTLER TOLEDO) calibrated in Kg.

Data Analysis

Analysis of Variance (ANOVA) was employed in the determination of breed, sex and location effects on carcass traits of some Nigerian sheep breeds. This was achieved by subjecting the data to the General Linear Model of SAS, (2002) version 9.0. Significantly different means were compared using Duncan Multiple Range Test (DMRT) (Duncan, 1955). The model shown below was utilized for the study:

$Y_{ijkl} = \mu + B_i + S_j + L_k + (BS)_{ij} + (BL)_{ik} + (SL)_{jk} + (BSL)_{ijk} + e_{ijkl}$

μ = Overall mean

Y_{ijkl} = Observation on dependent variables

B_i = Effect of i^{th} breed (1, 2, 3); 1 = Yanksa sheep, 2 = Uda sheep, 3 = Balami sheep

S_j = Effect of j^{th} sex (1, 2); 1 = Male, 2 = Female

L_k = Effect of K^{th} location (1,2,3); 1 = Gombe, 2 = Yobe, 3 = Borno

$(BS)_{ij}$ = Interaction between breed and sex

$(BL)_{ik}$ = Interaction between breedand location

$(SL)_{jk}$ = Interaction between sex and location

$(BSL)_{ijk}$ = Combined interaction between breed, sex and location

e_{ijkl} = Random error

RESULTS AND DISCUSSION

The descriptive statistics, specifically the coefficients of variation (CV), for carcass traits of some Nigerian indigenous sheep are presented in Table 2. In Yankasa, CV ranged from 21.33% (loin weight) to 45.26% (neck weight); in Uda, from 20.70% (loin weight) to 35.54% (neck weight); and in Balami, from 17.09% (rack weight) to 24.89% (neck weight).

Generally, a CV above 30% is considered high and indicates greater phenotypic variability, which may be due to genetic differences, environmental influence, or both. While high CV values, such as 45.26% for neck weight in Yankasa, may reflect potential for improvement through selection, they may also indicate less uniformity, which can be undesirable for market-oriented production where consistency in carcass yield is critical.

Table 2: Descriptive statistics of carcass traits of some Nigerian sheep breeds

	Yankasa			Uda			Balami		
Variable	Mean	SD	CV (%)	Mean	SD	CV (%)	Mean	SD	CV (%)
HCW	44.34	11.42	25.75	45.49	11.00	24.18	53.24	11.28	21.19
NW	4.36	1.97	45.26	5.54	1.97	35.52	7.65	1.89	24.89
SHW	6.43	2.00	31.06	7.07	2.25	31.88	9.18	1.80	19.60
RckW	6.26	1.58	25.17	7.14	1.86	26.02	10.71	1.83	17.09
BrW	4.20	1.01	24.01	4.40	0.94	21.42	4.43	1.10	24.73
LgW	14.90	3.98	26.70	15.12	3.13	20.70	15.96	3.66	22.91
LnW	5.77	1.23	21.33	6.09	1.38	22.62	6.46	1.51	23.42

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight. (SD) Standard deviation and (CV) Coefficient of variation.

Carcass traits of some Nigerian indigenous sheep according to location are presented in Table 3. Location had a significant effect ($p<0.05$) on hot carcass weight (HCW), neck weight (NW), shoulder width (SHW), rack weight (RckW), breast weight (BrW), leg weight (LgW), and loin weight (LnW). Sheep from Borno State recorded the highest mean values for all traits, followed by those in Yobe, with the lowest values in Gombe State.
In the present study, the heavier carcass components in sheep from Borno State compared to those from Yobe and Gombe agree with Tegegne and Assefa (2010), who reported that sheep from the highlands of Ethiopia had superior carcass merit compared to those from the lowlands. Similarly, Tolera (2012) observed significant effects of location on carcass traits of sheep native to Oromia, Ethiopia, with overall mean values of 37.00 kg, 31.97 kg, 17.20 kg, 16.83 kg, 2.13 kg, 46.47%, 53.80%, 45.48%, 13.38 cm², and 2.08 mm for slaughter weight, empty body weight, hot carcass weight, chilled carcass weight, chilling shrinkage, dressing percentage on slaughter weight (DPSW), dressing percentage on empty body weight (DPEBW), cold carcass dressing percentage (CCDP), rib eye area, and fat thickness, respectively. Ayele *et al.* (2019) also reported that location had a marked effect on carcass traits in some Ethiopian sheep breeds.

Table 3: Effect of location on carcass traits of sheep

Variable	Gombe	Yobe	Borno	P-value
HCW	44.21±1.46^{b}	45.29±1.43^{b}	53.56±1.43^{a}	0.000
NW	5.11±0.11^{b}	5.24±0.11^{b}	7.21±0.11^{a}	0.000
SHW	6.76±0.19^{b}	6.96±0.18^{b}	8.95±0.18^{a}	0.000
RckW	7.50±0.21^{b}	7.83±0.20^{b}	8.78±0.20^{a}	0.000
BrW	4.00±0.12^{b}	4.08±0.11^{b}	4.95±0.11^{a}	0.000
LgW	14.54±0.46^{b}	14.87±0.45^{b}	16.56±0.45^{a}	0.004
LnW	5.88±0.18^{b}	5.86±0.17^{b}	6.58±0.17^{a}	0.005

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW)
Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Carcass traits of Yankasa, Uda, and Balami sheep found in Gombe, Yobe, and Borno States are presented in Tables 4, 5, and 6, respectively. In each location, Balami sheep recorded the highest values for all traits that were significantly affected by breed ($p<0.05$), followed by Uda and Yankasa. Traits such as BrW, LgW, and LnW showed no significant variation ($p>0.05$) among the breeds, indicating a general similarity in these carcass components across the studied population.
The significant breed effect observed on carcass cuts in this study supports the findings of Cardoso *et al.* (2013), who reported differences in HCW, CCW, and CWH among Texel × Santa Ines, Ile de France × Santa Ines, and pure Santa Ines sheep, with crossbred animals showing higher HCW than pure Santa Ines, and Texel crosses recording the heaviest CCW and CWH. Landim*et al.* (2007) also found that crossbred sheep exhibited greater growth potential than purebred Santa Ines. Pires*et al.* (2006) reported higher hot, cold, and half carcass weights in crossbreds, emphasizing the potential for developing specialized meat breeds from Santa Ines, Texel, and Ile de France. Osório*et al.* (2002) observed significantly higher hot and cold carcass yields of 46.3 and 42.9 kg/100 kg, respectively, in crossbred lambs. Cardoso *et al.* (2013) further noted that Texel × Santa Ines crosses had heavier legs, backs, and ribs compared to other genotypes, attributing this to selective improvement for meat production. Pilar (2002) emphasized that carcass cut proportions are key indicators for commercial evaluation due to their varying economic values. Differences in carcass composition can be influenced by genetics, diet, slaughter weight, and sex. Heavier lambs generally produce heavier carcass and non-carcass components. Costa *et al.* (2003) reported that edible viscera can contribute up to 5% of carcass commercialization receipts, while Huidobro and Villapadierna (1992) classified parts such as the heart, head, and kidneys as early maturing, lungs, spleen, small intestine, and blood as intermediate, and skin, pancreas, stomach, and large intestine as late maturing. Rosa *et al.* (2002) noted that genotype, sex, and digestive tract size especially the reticulum-rumen can significantly influence carcass components, including the *longissimusdorsi.*

Table 4: Effects of breed on carcass traits of sheep in Gombe State

Variable	Yankasa	Uda	Balami	P-value
HCW	40.78±3.60	43.98±4.50	47.86±1.90	0.379
NW	3.60±0.67^{b}	4.81±0.70^{ab}	6.71±0.44^{a}	0.004
SHW	5.15±0.43^{b}	5.98±0.84^{b}	8.92±0.33^{a}	0.000
RckW	5.57±0.55^{b}	7.00±0.85^{b}	9.70±0.32^{a}	0.000
BrW	3.80±0.17	3.98±0.42	4.10±0.37	0.768
LgW	12.34±0.54	15.03±1.45	15.88±1.08	0.049
LnW	5.45±0.0.58	5.92±0.26	6.08±0.52	0.784

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW)
Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 5: Effects of breed on carcass traits of sheep in Yobe State

Variable	Yankasa	Uda	Balami	P-value
HCW	44.66±4.88	48.38±3.12	42.85±2.00	0.538
NW	4.02±0.70^{b}	4.87±0.41^{b}	6.83±0.35^{a}	0.002
SHW	6.73±0.81	7.87±0.41	6.29±0.44	0.163
RckW	6.38±0.59^{b}	6.89±0.37^{b}	10.22±0.54^{a}	0.000
BrW	3.64±0.28	4.20±0.17	4.39±0.46	0.250
LgW	14.08±1.32	14.50±0.60	16.04±1.67	0.530
LnW	5.26±0.45	5.67±0.23	6.66±0.62	0.108

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW)
Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 6: Effects of breed on carcass traits of sheep in Borno State

Variable	Yankasa	Uda	Balami	P-value
HCW	47.59±1.64^{b}	49.63±3.34^{b}	63.48±3.19^{a}	0.001
NW	5.47±0.33^{b}	6.75±0.64^{b}	9.40±0.57^{a}	0.000
SHW	7.42±0.37^{b}	8.70±0.62^{b}	10.74±0.54^{a}	0.000
RckW	6.83±0.24^{b}	7.28±0.57^{b}	12.22±0.53^{a}	0.000
BrW	4.79±0.14	4.92±0.25	5.14±0.26	0.533
LgW	15.47±0.97	15.96±0.59	18.26±1.00	0.071
LnW	6.02±0.29	6.65±0.24	7.07±0.39	0.076

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW)
Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Average carcass traits of Yankasa, Uda, and Balami sheep by sex are shown in Tables 7, 8, and 9, respectively. Sex significantly affected ($p<0.05$) all carcass traits in Uda and Balami, while in Yankasa, only HCW and NW were significantly different. In all cases, males recorded higher values than females. These findings are consistent with Agamy*et al.* (2015), who reported that male sheep had heavier hot carcasses, racks, loins, breasts, and legs than females, attributing this to androgenic effects in males, which promote muscular growth, and estrogenic effects in females, which promote fat deposition. Hulunim (2014) attributed sex-related differences in carcass traits partly to morphometric differences, noting that sexual dimorphism also extends to certain edible visceral organs such as the liver, lungs, heart, and kidneys. Silva *et al.* (2000) found heavier shoulders in rams than ewes, while Pires*et al.* (2011) observed no sex effect on shoulder weight in Ile de France × Texel lambs, attributing uniformity to 100% direct heterosis compared to pure Santa Ines. Tahir (2005) reported that carcass cuts vary by sex at sexual maturity. Similarly, Al-Mamun (2020) found significantly higher carcass prime cut values in rams than in ewes in Australian sheep breeds.

Table 7: effects of Sex on carcass traits of Yankasa

Variable	Male	Female	P-value
HCW	43.33±2.03	36.36±2.18	0.047
NW	4.00±0.17	2.73±0.36	0.000
SHW	6.80±0.40	5.06±0.35	0.094
RckW	6.17±0.28	5.35±0.38	0.508
BrW	4.18±0.19	3.67±0.23	0.674
LgW	15.34±0.81	13.58±0.61	0.517
LnW	6.33±0.33	5.60±0.31	0.915

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW)
Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 8: Effects of Sex on carcass traits of Uda

Variable	Male	Female	P-value
HCW	45.87±2.04	37.11±1.59	0.000
NW	5.18±0.32	3.90±0.22	0.000
SHW	6.77±0.40	5.37±0.36	0.000
RckW	6.67±0.30	5.60±0.22	0.001
BrW	4.95±0.20	3.86±0.20	0.000
LgW	15.21±0.69	13.03±0.50	0.000
LnW	5.55±0.25	4.99±0.24	0.001

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 9: effects of Sex on carcass traits of Balami sheep

Variable	Male	Female	P-value
HCW	54.75±3.67	51.73±1.95	0.000
NW	7.79±0.47	6.50±030	0.000
SHW	9.73±0.58	8.62±0.26	0.000
RckW	10.94±0.58	10.49±0.35	0.000
BrW	4.28±0.33	4.12±0.18	0.001
LgW	15.38±1.25	14.41±0.77	0.000
LnW	6.11±0.47	6.06±0.20	0.000

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight,
(RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Interaction effects of breed × sex, location × sex, breed × location and breed x location x sex on carcass traits are presented in Tables 10, 11, 12 and 13, respectively. Breed × sex interaction significantly ($p<0.05$) affected HCW, NW, SHW, RckW, BrstW, LgW, and LnW. Location × sex

interaction significantly influenced NW, RckW, BrstW, and LnW. Breed × location interaction significantly affected SHW, RW, TL, HCW, NW, SHW, RckW, LgW, and LnW. Breed x location x sex interaction had no significant effect on all the carcass traits recorded. The significant breed × sex interaction observed here agrees with Hoseini et al. (2010), who reported heavier hot carcass, leg, shank, rack, and loin in Moghani rams. Hopkins and Mortimer (2014) also noted that breed × sex interaction significantly affects carcass quality and yield traits. The breed × location interaction observed where the highest means were recorded in Balami sheep from Borno and the lowest in Yankasa from Gombe aligns with Cam et al. (2010), who found higher dressing percentages and prime cuts such as rack, leg, loin, and breast in Karayaka sheep from certain locations compared to other indigenous breeds, attributing differences to genetic makeup and environmental conditions.

Table 10: Interaction effects of breed and sex on carcass traits of sheep

	Yankasa		Uda		Balami		
Variable	Male	Female	Male	Female	Male	Female	P-value
HCW	52.33±1.75^{a}	36.36±1.75^{b}	53.87±1.75^{a}	37.11±1.75^{b}	54.75±1.75^{a}	51.73±1.75^{a}	0.000
NW	5.99±0.16^{c}	2.73±0.16^{d}	7.19±0.16^{b}	3.90±0.16^{d}	8.79±0.16^{a}	6.50±0.16^{b}	0.003
SHW	7.80±0.26^{b}	5.37±0.26^{c}	8.78±0.26^{a}	5.06±0.26^{c}	9.73±0.26^{a}	8.63±0.26^{a}	0.000
RckW	7.17±0.28^{c}	5.35±0.28^{d}	8.68±0.28^{b}	5.60±0.28^{d}	10.94±0.28^{a}	10.49±0.28^{a}	0.000
BrW	4.28±0.16^{b}	3.67±0.16^{c}	4.95±0.16^{a}	3.86±0.16^{c}	5.18±0.16^{a}	4.12±0.16^{b}	0.000
LgW	14.41±0.64^{c}	13.03±0.64^{c}	17.22±0.64^{a}	13.58±0.64^{c}	18.34±0.64^{a}	15.38±0.64^{b}	0.000
LnW	6.56±0.24^{b}	4.99±0.24^{c}	6.11±0.24^{a}	5.60±0.24^{c}	7.33±0.24^{a}	6.06±0.24^{b}	0.001

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 11: Interaction effects of Location and sex on carcass traits of sheep

	Gombe		Yobe		Borno		
Variable	Male	Female	Male	Female	Male	Female	P-value
HCW	49.63±1.75	36.19±1.75	52.23±1.75	40.96±1.75	59.08±1.75	48.04±1.75	0.107
NW	6.80±0.16^{b}	3.42±0.16^{c}	6.51±0.16^{b}	3.96±0.16^{c}	8.66±0.16^{a}	5.76±0.16^{b}	0.036
SHW	8.03±0.26	5.50±0.26	8.05±0.26	5.87±0.26	10.22±0.26	7.68±0.26	0.735
RckW	8.89±0.28^{b}	6.12±0.28^{d}	8.35±0.28^{b}	7.31±0.28^{c}	9.55±0.28^{a}	8.01±0.28^{b}	0.011
BrW	4.35±0.16^{b}	3.26±0.16^{c}	4.74±0.16^{b}	3.81±0.16^{c}	5.32±0.16^{a}	4.58±0.16^{b}	0.012
LgW	15.67±0.64	12.63±0.64	16.46±0.64	14.08±0.64	17.84±0.64	15.29±0.64	0.222
LnW	6.20±0.24^{a}	4.91±0.24^{c}	6.84±0.24^{a}	5.53±0.24^{b}	6.90±0.24^{a}	6.26±0.24^{a}	0.014

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 12: Interaction effect of breed and location on carcass traits of sheep

	Yankasa			Uda			Balami			
Variable	Gombbe	Yobe	Borno	Gombe	Yobe	Borno	Gombe	Yobe	Borno	P-value
HCW	40.78±2.14^{c}	43.99±2.14^{c}	49.63±2.14^{b}	42.85±2.14^{c}	44.66±2.14^{c}	47.59±2.14^{b}	47.86±2.14^{b}	48.38±2.14^{b}	63.47±2.14^{a}	0.036
NW	3.60±0.19^{d}	4.02±0.19^{d}	5.47±0.19^{c}	4.87±0.19^{c}	5.02±0.21^{c}	6.75±0.19^{b}	6.71±0.19^{b}	6.83±0.19^{b}	9.40±0.19^{a}	0.025
SHW	5.15±0.32^{c}	6.29±0.32^{c}	8.70±0.32^{b}	6.23±0.33^{c}	6.73±0.32^{c}	7.42±0.32^{b}	7.87±0.32^{b}	8.92±0.32^{b}	10.74±0.32^{a}	0.001
RckW	5.57±0.35^{c}	6.38±0.35^{c}	7.28±0.35^{c}	6.89±0.35^{d}	7.24±0.37^{c}	6.83±0.35^{c}	9.70±0.35^{b}	10.22±0.35^{b}	12.23±0.35^{a}	0.007
BrW	3.64±0.20	3.80±0.20	4.79±0.20	4.09±0.21	4.20±0.20	4.92±0.20	4.10±0.20	4.39±0.20	5.14±0.20	0.081
LgW	12.34±0.78^{c}	14.08±0.78^{c}	15.47±0.78^{b}	14.50±0.78^{c}	15.40±0.83^{b}	16.04±0.78^{a}	15.88±0.78^{b}	15.96±0.78^{b}	18.26±0.78^{a}	0.001
LnW	5.63±0.32^{c}	5.26±0.30^{c}	6.02±0.30^{b}	5.92±0.30^{c}	5.67±0.30^{c}	6.66±0.30^{b}	6.08±0.30^{b}	6.65±0.30^{b}	7.07±0.30^{a}	0.035

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

Table 13: Interaction effect of breed, location and sex on carcass traits of sheep

	Yankasa						Uda						Balami						
	Gombe		Yobe		Borno		Gombe		Yobe		Borno		Gombe		Yobe		Borno		
Variables	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	p-value
HCW	50.00±3.05	31.55±3.05	57.78±3.05	31.52±3.05	49.19±3.05	45.98±3.05	56.29±3.41	31.79±3.05	46.35±3.05	39.34±3.05	59.06±3.05	40.18±3.05	50.49±3.05	45.22±3.05	44.75±3.05	51.99±3.05	68.99±3.05	57.95±3.05	0.341
NW	5.54±0.27	1.65±0.27	6.03±0.27	1.99±0.27	6.40±0.27	4.54±0.27	6.90±0.30	3.12±0.27	6.00±0.27	3.73±0.27	8.64±0.27	4.85±0.27	7.93±0.27	5.47±0.27	7.50±0.27	6.15±0.27	10.93±0.27	7.86±0.27	0.067
SHW	6.22±0.44	4.06±0.44	8.93±0.44	4.52±0.44	8.24±0.44	6.59±0.44	8.42±0.49	4.03±0.44	7.43±0.44	5.14±0.44	10.46±0.44	6.92±0.44	9.42±0.44	8.40±0.44	7.79±0.44	7.94±0.44	11.95±0.44	9.52±0.44	0.541
RckW	7.01±0.49	4.13±0.49	7.84±0.49	4.91±0.49	6.65±0.49	6.99±0.49	9.42±0.55	5.06±0.49	7.70±0.49	6.08±0.49	8.90±0.49	5.65±0.49	10.22±0.49	9.16±0.49	9.51±0.49	10.92±0.49	13.08±0.49	11.36±0.49	0.811
BrW	5.06±0.27	3.13±0.27	5.62±0.27	3.15±0.27	4.84±0.27	4.73±0.27	5.11±0.31	3.07±0.27	4.16±0.27	4.24±0.27	5.58±0.27	4.24±0.27	4.03±0.27	3.57±0.27	3.25±0.27	4.02±0.27	5.54±0.27	4.74±0.27	0.665
LgW	18.26±1.10	13.49±1.10	20.50±1.10	11.57±1.10	16.23±1.10	15.68±1.10	18.70±1.24	12.09±1.10	14.84±1.10	14.15±1.10	18.11±1.10	12.82±1.10	12.40±1.10	12.28±1.10	11.66±1.10	16.50±1.10	19.17±1.10	17.35±1.10	0.766
LnW	7.39±0.42	4.77±0.42	8.27±0.42	5.05±0.42	6.32±0.42	6.97±0.42	7.16±0.47	4.08±0.42	5.74±0.42	5.59±0.42	6.76±0.42	5.28±0.42	5.97±0.42	5.87±0.42	4.58±0.42	5.94±0.42	7.62±0.42	6.52±0.42	0.115

(HCW) Hot carcass weight, (NW) Neck weight, (SHW) Shoulder weight, (RckW) Rack weight, (BrW) Breast weight, (LgW) Leg weight and (LnW) Loin weight.

CONCLUSIONS

This study demonstrated that rams consistently exhibited higher values than ewes across all significantly affected carcass traits. Among the breeds evaluated, Balami sheep showed superior performance, recording the highest values for all measured carcass traits. Additionally, sheep sourced from Borno State had the most favorable carcass characteristics, followed by those from Yobe and Gombe states.

These results provide valuable insight into the role of breed, sex, and location in determining carcass yield in Nigerian sheep. In particular, Balami rams from Borno State appear especially promising for genetic improvement programs and regional meat production initiatives. Their superior carcass attributes make them ideal candidates for targeted breeding and management strategies aimed at enhancing meat yield and overall productivity in the sheep sector.

References

Adetunji, V. O., Salako, A. E., Ozoje, M. O. &Yakubu, A. (2021).Genetic improvement strategies for small ruminant production in sub-Saharan Africa.*Agriculture*, 11(4), 1-21.

Adeyemi, O. A., Salako, A. E., Ajiboye, T. O. &Afolayan, S. B. (2021). Genetic resources and management of small ruminants in Nigeria: A review. *Journal of Animal Science and Technology*, 63(1), 75-91.

Agamy, R, Abdel-Moneim, A. Y., Abd-Alla, M. S., Abdel-Mageed, I. I. &Ashmawi, G. M. (2015).Using linear body measurements to predict body weight and carcass characteristics of three Egyptian fat-tailed sheep breeds.*Asian Journal of Animal and Veterinary Advances*, 10(7), 335-344. DOI: https://www.doi.org/10.3923/ajava.2015.335.344

Akusu, M.O., Asiribo, O.E., &Ahemen, T. (2021).Morphometric analysis of body measurements and morphological characterization of West African Dwarf sheep in Makurdi, Nigeria.*Journal of Agriculture and Veterinary Science*, 14(1), 24-33.

Al-Atiyat, R. M., Aljumaah, R. S., Alshaikh, M. A. &Abdoun, K. A. (2021). Carcass characteristics of Najdi lambs reared under intensive and semi-intensive production systems. *Journal of Animal Science and Technology*, 63(2), 232-240. https://doi.org/10.5187/jast.2021.e35

Al-Mamun, H. A. (2020). Genetic parameters for growth and carcass traits of sheep in Australia.*Small Ruminant Research*, 185, 106079, doi: 10.1016/j.smallrumres.2019.106079.

Ayele, S., Urge, M., Animut, G. & Yusuf, M. (2019). Comparative slaughter performance and carcass quality of three Ethiopian fat-tailed hair sheep breeds supplemented with two levels of concentrate. *Tropical Animal Health and Productin*, 51 (1), 187–198.

Balcı, F., Kökdil, G., Uslu, B. A. &Oğuz, M. N. (2021).Effects of genotype and feeding system on carcass traits and meat quality of Kıvırcık lambs.*Journal of Animal Science and Technology*, 63(4), 880-892. https://doi.org/10.5187/jast.2021.e76

Cam, M. A., Olfaz, M. &Soydan, E. (2010). Possibilities of using morphometric characteristics as a tool for body weight prediction in Turkish hair goats (Kilkeci). *AsianJournal of Animal and Veterinary Advances*, 5(1), 52-59.

Cardoso, M. T. M., Landim, A. V., Louvandini, H. & McManus, C. (2013).Performance and carcass quality in three genetic groups of sheep in Brazil.*RevistaBrasileira de Zootecnia*, 42 (10), 734-742.

Costa, R. G., Medeiros, A. N. &Madruga, M. (2003).Rendimento de vísceraspara "buchada" emcaprinosSaanenalimentados com diferentesníveis de volumoso e concentrado. In: SimposioInternacional de Caprinose e Ovinos de Corte, João Pessoa. AnaisJoão Pessoa.Pp: 663-666.

FAOSTAT.(2021). FAO Statistical Yearbook 2020. Food and Agriculture Organization of the United Nations: Rome, Italy. Accessed on 19 February 2023. Available online at: http://www.fao.org/faostat/en/#data/QA/visualize

Hopkins, D. L. & Mortimer, S. I. (2014). Effect of genotype, gender and age on sheep meat quality and a case study illustrating integration of knowledge.*Meat Science*, 98, 544–555. doi:10.1016/j.meatsci.2014.05.012

Hoseini, V. M., Miraei A. R., Pakdel, A. &Moradi, H. (2010). Evaluation the accuracy of body linear measurements in Moghani lambs to predict carcass productionand carcass fat content after slaughter. The 4th Iranian Congress on Animal Science, Karaj, Iran.

Huidobro, F. R. &Villapadierna, A. (1992).Estudiossobrecrecimiento y desarrollo en corderos de razaManchega.Thesis (Doctoral) - Universidad Complutense, Madrid.Pp: 191.

Hulunim, G. (2014). On-farm phenotypic characterization and performance evaluation of Bati, Borena and short eared Somali goat populations of Ethiopia. M.Sc. thesis submittedto the School of Graduate Studies of Haramaya University, Ethiopia.Pp: 140.

Kafkas, E. &Yakan, A. (2021). Evaluation of carcass and meat quality characteristics in Karacabey Merino and Kıvırcık breeds of sheep. *Journal of Animal Science and Technology*, 63(2), 270-281. https://doi.org/10.5187/jast.2021.e40

Landim. A. V., Mariante, A. S. & McManus, C. (2007). Característicasquantitativas da carcaça, medidasmorfométricas e suascorrelaçõesemdiferentesgenótipos de ovinos.*Ciência Animal Brasileira*, 8, 665-676.

Osori, J. C. S., Oliveira, N. M. & Osorio, M. T. M. (2002).Produção de carne emcordeiros Border

Leicester com ovelhasCorriedale e Ideal.*RevistaBrasileira de Zootecnia*, 31, 1469-1480.

Oyeyemi, M. O., Ojo, V., Ajani, F. &Alokan, J. A. (2020). Morphometric and productivity traits of West African Dwarf sheep in a semi-arid environment. *Tropicultura*, 38(2), 155-164.

Pilar, R. C., Perez, J. R. O. & Santos, C. L. (2002).Manejoreprodutivo da ovelharecomendaçõesparaumaparição a cada 8 meses. *BoletimAgropecuário*, 50, 1-28.

Pires, C. C., Carneiro, R. M. & Muller, L. (2006).Avaliação da carcaça e componentes do peso vivo, de cordeiros de partosimplesdesmamados, parto simples nãodesmamados e de partoduplodesmamado. *RevistaBrasileiraAgrociência*, 12, 93-97.

Pires, C. C., Muller, L. &Tonetto, C. J. (2011).Influênciadotipodeparto e do sexo no desempenho e nascaracterísticas de carcaça de cordeiroscruza Ile de France x Texel. *Revista Ceres*, 58, 432-437.

Rodríguez-Sánchez, J. A., Pérez-Guzmán, M. D., Sánchez-Carrasco, J. A. &Albarrán-Portillo, B. (2020). The effect of different concentrate feeding systems on carcass traits of fattening lambs. *Tropical Animal Health and Production*, 52(1), 119-124. https://doi.org/10.1007/s11250-019-02049-z

Rosa, G. T., Pires, C. C. & Silva, J. H. (2002).Proporções e coeficientesdecrescimento dos nãocomponentes da carcaça de cordeiros e cordeirasemdiferentesmétodos de alimentação.*RevistaBrasileira de Zootecnia*, 31, 2290-2298.

Silva, L. F., Pires, C.C. &Zeppenfeld, C. C. (2000).Crescimento de regiões da carcaça de cordeirosabatidos com diferentes pesos.*Ciência Rural*, 30, 481-484.

Tegegne, F. &Assefa, G. (2010). Feed Resources Assessment in Amhara Regional State. Ethiopia Sanitary and Phytosanitary Standards and Livestock and Meat Marketing Program. (SPAS-LMM) Texas A&M University System, 2010.http://borlaug.tamu.e

Tolera, A. (2012). Feed Resources for Producing export Quality Meat and Livestock in Ethiopia, Examples from Selected Woredas in Oromia and SNNP Regional States. Ethiopia Sanitary and Phytosanitary Standards and Livestock and Meat Marketing Program (SPS-LMM) Texas A&M University System.2007. http://borlaug.ta (Accessed 24 April 2015).