MORPHOMETRIC, CARCASS MEASUREMENTS AND MUSCLE DISTRIBUTION OF FOUR BREEDS OF RAMS INTENSIVELY FATTENED

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ABSTRACT
This study was to investigate breed differences in live weight, carcass traits and muscle distribution of Balami (BA), Uda (UD), Yankasa (YK) and West African Dwarf rams (WAD). fForty-eight rams were randomly assigned into four groups of twelve rams per breed in a completely randomized design. Linear measurements were obtained weekly during the fattening period. At the end of the feeding trial, animals were subjected to a 18-hours fast and slaughtered for carcass measurements and muscle distribution. Results showed that BA and UD had higher values for body length (115.75±4.25 and 110.25±1.89), withers height (70.50±5.57 and 69.00±2.16) and heart girth (92.00±2.94 and 84.00±1.41), than YK (96.50±3.87, 60.75±3.30 and 76.75±0.96), respectively which in turn had higher values than WAD (86.50±5.20, 53.25±5.32 and 75.25±3.30). Carcass length, pistola length, and leg length were 75.75±4.79, 60.75±7.14 and 88.00±2.16; 75.50±4.66, 56.00±5.00 and 80.25±5.80; 59.00±7.79, 56.00±10.62 and 71.50±2.65; 60.50±3.11, 53.75±5.91 and 61.00±2.94cm for BA, UD, YK and WAD rams, respectively. BA and UD had higher proportion of muscle distribution and were generally better than the YK and WAD breeds. This may boost their potential for large scale meat production under fattening conditions.
Keywords Breeds, Meat, Growth . Morphology, Carcass, Muscle distribution

INTRODUCTION
Nigeria livestock industry is small and slow-growing relative to the population relying on it for meat (Agboola and Balcilar, 2012). The use of specialised meat breeds to improve animal productivity is desirable in intensive sheep production. Locally adapted breeds of rams have attributes that can be used in a collective and valuable approach to increase meat production and improving their connections to the market (FAO, 2012). Morphometric measurements have been used to evaluate the characteristics of various breeds of animals and could provide first-hand information on the suitability of animals for selection (Yakubu, 2010). Muscularity indicates the amount of muscle tissue, determined by muscle to bone ratio and fatness describes the external and internal deposition of fat in the carcass. According to Srivastava *et al* (1968), body measurements are indices of skeletal development and indirectly help to determine carcass composition. Another parameter that was used over the years to estimate the amount of meat that could be obtained from slaughtered animals is carcass measurement. De Boer *et al* (1974) identified four types of linear carcass measurements. The objectives of the present study were to compare various measurements of body, carcass and tissue distribution for Balami, Uda, Yankasa and West African Dwarf breeds of ram intensively managed.

MATERIALS AND METHODS
Location and management of experimental animals
The study was conducted at the Sheep and Goat unit of the Teaching and Research Farm, University of Ibadan. Twelve rams each of Balami (BA), Uda (UD), Yankasa (YK) and West African Dwarf (WAD) breeds , weighing 17.00± 0.39–19.38±0.39 (12-18 months of age). At the end of the ninety days, four rams in each group whose weights were the closest to average final weight of the rams of their respective breeds were chosen for subsequent carcass analysis.

LINEAR BODY MEASUREMENTS
The six morphometric traits measured were height at wither, pelvis height, body length, heart girth, chest width and chest depth. Measurement (cm) was done using a graduated measuring stick and tape rule. To achieve this, animals were placed on a flat ground and held by two field assistants. The length measurements were carried out using a tape rule while the width measurements (cm) were taken using a calibrated wooden calliper.

SLAUGHTER PROCEDURE

The selected sixteen rams from the four breeds were transported to the slaughterhouse of the Department of Animal Science, University of Ibadan where pre-slaughter live weight was recorded after 18-hours of fasting with free access to water. Exsanguination was carried out by an incision on the jugular furrow at the occipito-atlantal junction close to the head, severing the carotid arteries, jugular veins, trachea, oesophagus and the spinal cord. The head was removed and the carcass was hung by the hind legs using a pulley and then skinned.

EVISCERATION OF CARCASSES AND CARCASS EVALUATION:

Skinning and evisceration was carried out and hot carcass weight was taken on the slaughter floor within 10min post-motem. The carcass was chilled for twenty-four hours at 3^{o}C-4^{o}C and reweighed to get chilled carcass weight. Dimensional measurements taken on the carcasses were: Carcass Length, Length of Hindleg, Length of Foreleg, Heart Girth and Depth of Chest according to the procedures of De Boer *et al.* (1974). Abdominal, pectoral, Kidney and pelvic fats were removed, weighed and calculated as a percentage of the hot carcass weight. Carcasses were split along the midline. The left sides were separated as outlined by Fisher and De Boer (1994). These included carcass length and depth, and leg length. The length of the pistola was obtained following quartering of the carcass side. After a 24-h chilling period (4°C), the right side of each carcass was cut through the spinal column between the 5th and 6th thoracic vertebrae.

DISSECTION OF MUSCLES

Dissection of the chilled half carcass was carried out by making incision at the point of insertion and origin to harvest the following muscles semimembranosus, semitendinosus, biceps femoris, adductor, gluteus medius, deltoideus, supraspinatus, infraspinatus, subscapularis. The muscles were weighed separately, then their relative proportions to the cold carcass weight (CCW) and recorded. Dissection was carried out using the dissecting set apparatus following the procedures of Sisson and Grossman (1953).

STATISTICAL ANALYSES

Data were statistically analysed using the general linear models procedure of the Statistical Analysis System Institute (SAS, 1996).

RESULTS AND DISCUSSION

Body measurements

Linear measurements in relation to weight are shown in Table1 as objective measure of carcass blockiness. BA (115.75±4.25 and 70.50±5.57) and UD (110.25±1.89 and 69.00±2.16) had significantly higher values than YK (96.50±3.87 and 60.75±3.30) and WAD (86.50±5.20 and 53.25±5.32) for body length and wither height, the values for YK were greater than WAD. BA had a significantly pelvis chest than UD (80.25±5.80) and WAD (61.00±2.94), which were not different (P>0.05). When expressed relative to live weight, BA and WAD differed significantly for all values, where as UD (84.00±1.41 and 80.25±5.80) had significantly higher values for heart girth and pelvis height than WAD (75.25±3.30 and 61.00±2.94). The slaughter weight in the present study reflects commercial practices and maintains good comparability with other breed. The findings indicated that body measurements can be used for estimation of body weight of animals in the field where scales are not readily available. Lavvaf *et al*. (2012) observed that chest depth and rump width were suitable factor for predicting hot carcass weight in each of Afshari and Zandi sheep, respectively. These measurements provide important evidences for the growth of the breed and information about the morphological structure and development ability of the animals.

Table 1: Morphometric Measurements of four breeds of rams intensively fattened

Parameters	BA	UD	YK	WAD
Live weigth (kg)	36.59±1.83	37.00±0.82	36.00±1.83	36.39±2.38
Measurements (cm)				
Body length	115.75±4.25^{a}	110.25±1.89^{a}	96.50±3.87^{b}	86.50±5.20^{c}
Wither heigth	70.50±5.57^{a}	69.00±2.16^{a}	60.75±3.30^{b}	53.25±5.32^{c}
Heart girth	92.00±2.94^{a}	84.00±1.41^{a}	76.75±0.96^{c}	75.25±3.30^{c}
Pelvis heigth	88.00±2.16^{a}	80.25±5.80^{b}	71.50±2.65^{c}	61.00±2.94^{d}
Chest width	18.75±0.50	19.25±0.50	17.75±1.71	17.75±3.30
Chest depth	33.00±2.58^{a}	33.00±3.74^{a}	29.50±2.65^{ab}	25.75±0.96^{b}
Measurements relative to liveweight (cm/100g)				
Body length	3.17±0.16^{a}	2.98±0.11^{ab}	2.77±0.23^{b}	2.76±0.26^{b}
Wither heigth	1.93±0.09^{a}	1.87±0.03^{ab}	1.74±0.16^{ab}	1.70±0.20^{b}
Heart girth	2.52±0.07^{a}	2.27±0.06^{ab}	2.20±0.12^{bc}	2.40±0.17^{c}
Pelvis heigth	2.41±0.09^{a}	2.17±0.15^{b}	2.05±0.17^{bc}	1.94±0.14^{c}
Chest width	0.51±0.04	0.52±0.02	0.51±0.07	0.57±0.11
Chest depth	0.09±0.07	0.89±0.10	0.85±0.09	0.82±0.08

Means in the same along the same row with different superscripts are significantly different (P<0.05). BA: Balami, UD: Uda, YK: Yankasa, WAD: West African Dwarf

Carcass and measurements

Carcass measurements are presented in Table 2. The proportion of hot carcass weight was 18.72 ±1.85, 18.25±0.87, 17.72±0.17 and 17.72±1.26 for BA, UD, YK and WAD, respectively. Carcass and pistola length were significantly greater for BA (75.75±4.79 and 60.75±7.14) and UD (75.50±4.66 and 56.00±5.00) than YK (59.00±7.79 and 56.00± 10.62) and WAD (60.50±3.11). BA (88.00±2.16) had greater (P<0.05) leg length than both UD (80.25±5.80), YK (71.50±2.65) and WAD (61.00±2.94), which did not differ (P>0.05). When expressed relative to hot carcass weight, carcass length, carcass depth and pistola length were not significant between the breeds but were lower (P<0.05) for WAD. All the four breeds differed significantly for leg length relative to carcass weight, which was greatest for BA (0.46±0.04) and least for WAD (0.39±0.02). Breed significantly affected all carcass measurements except carcass depth, with BA having higher values for all traits. Linear carcass measurements and indexes are used as indicators of carcass conformation and size (Sañudo *et al.* , 1998c) . The results of the current study indicate significant effect of breed on carcass measurements and conformation indexes could be explained by breed specific morphologic characteristics of BA breeds.

Table 2. Hot carcass weight and carcass measurements of of four breeds of rams intensively fattened

Parameters	BA	UD	YK	WAD
Cold Carcass Weigth	18.72 ±1.85	18.25±0.87	17.72±0.17	17.72±1.26
Carcass Measurements (cm)				
Carcass Length	75.75±4.79^{a}	75.50±4.66^{a}	59.00±7.79^{b}	60.50±3.11^{b}
Carcass Depth	24.25±0.96	24.50±0.58	24.75±3.30	24.25±4.03
Pistola Length	60.75±7.14^{a}	56.00±5.00^{b}	56.00±10.62^{b}	53.75±5.91^{c}
Leg Length	88.00±2.16^{a}	80.25±5.80^{b}	71.50±2.65^{c}	61.00±2.94^{d}
Carcass Measurements (cm/100g carcass)				
Carcass Length	0.41±0.02^{a}	0.42±0.02^{a}	0.34±0.04^{b}	0.39±0.05^{ab}
Carcass Depth	0.13±0.01	0.14±0.01	0.14±0.02	0.15±0.01
Pistola Length	0.33±0.01	0.25±0.11	0.32±0.06	0.34±0.01
Leg Length	0.46±0.04^{a}	0.44±0.04^{b}	0.40±0.02^{bc}	0.39±0.02^{c}

Means in the same along the same row with different superscripts are significantly different (P<0.05). BA: Balami, UD: Uda, YK: Yankasa, WAD: West African Dwarf

MUSCLE MEASUREMENTS

Distribution of muscles are shown in Table 3. Weigth of SM and ST were significantly higher for BA (0.54±0.02) and UD (0.59±0.10) than YK (0.49±0.01) with WAD (0.47±0.03) being the lowest (P>0.05), whereas weight of the BF was significantly lower for WAD (0.22±0.06) and YK(0.25±0.05) than BA (0.36±0.01) and UD (0.39±0.06), which did not differ (P>0.05), The weigth of GM was

lower for YK (0.15±0.01) and WAD (0.15±0.02) than BA (0.18±0.01) and UD (0.17±0.01), which were similar (P>0.05). The weight of DP was higher for BA (0.63±0.06) than UD (0.42±0.11), YK (0.38±) and WAD (0.42±0.17), which were not significant to one another (P>0.05). The weight of IF (0.23±0.01), SP (0.18±0.05), DT (0.30±0.02) and SS (0.24±0.08) were significantly greater for BA. The relative weight of the SM was significantly higher for UD (0.51±0.08) and YK (0.45±0.01) than for BA (0.39±0.03)FR and WAD (0.38±0.02). The relative weight of the ST (0.40±0.04), ADD (0.38±0.03), GM (0.14±0.01) and BF (0.34±0.04) was significantly greater for UD than the values recorded for both BA and YK. The greater muscle of BA compared to the UD,YK and WAD breeds reflected the greater fleshiness and carcass conformation. The relative small differences in tissue distribution together with the non-significant differences in the proportion of muscle in the weight suggest that carcass conformation score is not a reliable indicator of traits (McGee *et al*., 2005).

Table 3. Hot carcass weight and percentage proportion of muscles of four breeds of rams intensively fattened

Parameters	Balami	Uda	Yankasa	WAD
Hot Carcass Weigth (HCW)	18.72 ±1.85	18.25±0.87	17.72±0.17	16.82±1.26
Muscle Measurements (g)				
Semimembranosus (SM)	0.54±0.02^{ab}	0.59±0.10^{a}	0.49±0.01^{b}	0.47±0.03^{b}
Semitendinosus (ST)	0.49±0.14^{a}	0.46±0.02^{ab}	0.37±0.02^{ab}	0.35±0.06^{b}
Adductor (ADD)	0.47±0.06	0.45±0.03	0.40±0.01	0.40±0.05
Gluteus Medius (GM)	0.18±0.01^{a}	0.17±0.01^{ab}	0.15±0.01^{c}	0.15±0.02^{bc}
Biceps femoris (BF)	0.36±0.01^{a}	0.39±0.06^{a}	0.25±0.05^{b}	0.22±0.06^{b}
Deep pectoralis (DP)	0.63±0.06^{a}	0.42±0.11^{b}	0.38±0.02^{b}	0.42±0.17^{b}
Infraspinatus (IF)	0.23±0.01^{a}	0.19±0.01^{b}	0.18±0.01^{b}	0.18±0.04^{b}
Supraspinatus (SP)	0.18±0.05^{a}	0.14±0.01^{b}	0.14±0.01^{b}	0.13±0.01^{b}
Deltoideus (DT)	0.30±0.02^{a}	0.27±0.01^{ab}	0.28±0.02^{ab}	0.25±0.02^{b}
Subscaplaris (SS)	0.24±0.08^{ab}	0.17±0.09^{b}	0.31±0.01^{a}	0.27±0.10^{ab}
Percentage proportion of muscle to HCW				
Semimembranosus	0.39±0.03^{bc}	0.51±0.08^{a}	0.45±0.01^{ab}	0.38±0.02^{c}
Semitendinosus	0.34±0.06^{ab}	0.40±0.04^{a}	0.34±0.02^{ab}	0.28±0.04^{b}
Adductor	0.33±0.01^{bc}	0.38±0.03^{a}	0.37±0.01^{ab}	0.32±0.04^{c}
Gluteus Medius	0.13±0.01^{bc}	0.14±0.01^{a}	0.13±0.00^{b}	0.12±0.01^{c}
Biceps femoris	0.25±0.01^{b}	0.34±0.04^{a}	0.24±0.05^{bc}	0.18±0.04^{c}
Deep pectoralis	0.45±0.09	0.37±0.11	0.35±0.01	0.34±0.13
Infraspinatus	0.17±0.01	0.16±0.01	0.17±0.01	0.14±0.03
Supraspinatus	0.13±0.04	0.12±0.00	0.13±0.01	0.11±0.01
Deltoideus	0.21±0.01^{bc}	0.23±0.00^{b}	0.26±0.02^{a}	0.20±0.02^{c}
Subscaplaris	0.17±0.04^{b}	0.22±0.06^{ab}	0.28±0.01^{a}	0.27±0.01^{a}

Means in the same along the same row with different superscripts are significantly different (P<0.05). BA: Balami, UD: Uda, YK: Yankasa, WAD: West African Dwarf

CONCLUSIONS

BA and UD breeds have higher values as demonstrated by the results, the use of BA and UD becomes valuable replacement for meat production. Improvements in genetics and husbandry are needed to improve the potential of these animals for efficient large scale meat production.

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