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Carcass tissue composition of autochthonous goats of the semi-arid zone of north-western Nigeria

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ABSTRACT

A study was conducted to investigate the influence of breed and age on carcass composition of Nigerian goats. Mean values of lean, bone, fat and lean: Bone ratios were 64.64, 31.95, 3.42 % and 2.05, respectively. Sokoto Red goats had more lean, less bone and higher lean: bone ratio than Sahel goats ($P<0.05$). Mature goats had significantly less bone and higher lean: bone ratio. There was significant breed x age interaction in carcass lean, carcass, bone and lean: bone ratio, such that the superiority of Sokoto Red in percent lean and lean: bone ratio and the higher percent bone of the Sahel hold true only among mature goats. Carcass fat was not influenced by breed or age of goats.

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1. Introduction

Meat production is the most important aspect of goat keeping in developing countries (Taneja, 1982; Terrill, 1986; Attah et al., 2004). The developing countries contribute about 95 % of the estimated 4.5 million metric tonnes total world goat meat production. Africa produces 851.05×10^3 metric tonnes, from an annual slaughter of about 69.7 million goats, while Nigeria slaughters an estimated 11.6 million goats to produce about 147.07×10^3 metric tonnes of meat annually (FAO, 2005).

Many experts believe that a sustainable development of goat meat production has the potential of improving the quality of life of people in developing countries (Griffin et al., 1992). According to Steinbach (1987) development of goat meat industry is could not be achieved without basic scientific information on meat production potential of indigenous breeds, which is generally lacking (Steinbach, 1987; Tshabalala et al., 2003). This dearth of information is evident in the Semi-arid zone of North-western Nigeria, a region that according to FDLPCS (1992) holds a greater proportion of the Nigerian national goat herd. Pioneer studies by Uko *et al.* (1999) and Hassan and Idris (2002) on goat meat in the study area were limited to dressing percentage and yields of carcass and offal of mixed breeds of goats at the Sokoto abattoir. There was no attempt at breed comparison of the indigenous breeds or studies on their carcass composition. It was for this reason that this research was undertaken to determine and compare carcass tissue composition of Sokoto Red and Sahel goats as affected by age at slaughter.

2. Materials and methods

2.1. Animals and their management

Experimental animals were thirty two intact bucks (16 Sahel and 16 Sokoto Red) conforming to body condition score "3" of the Australian standard for live goat evaluation (ESMGPA, 2005). The animals were procured from diverse village livestock markets in the study area. Breed identification was based on the classical phenotypic features described by Ngere *et al.* (1984) and Mason (1988). Prior to slaughter, the goats were rested for 24 hours during which they were maintained on an ad libitum diet of 2:1 v/v mix of cowpea husk and wheat offal. Free access to water was allowed.

2.2. Experimental layout

The experiment was arranged in a 2 x 2 factorial design thus: Breed (Sahel and Sokoto Red) and age (young and mature) and replicated four times (Table 1). Mature animals were those with one pair of permanent incisors, while young had only milk teeth.

Table 1
Tissue composition of goat carcasses (%) according to breed and age

Component	Breed		Age	
	Sokoto Red	Sahel	Young	Mature
Lean	65.53 ^a	63.75 ^b	63.84	65.43
Bone	30.68 ^b	33.21 ^a	32.86 ^a	31.03 ^b
Fat	3.80	3.04	3.30	3.53
Lean: Bone	2.16 ^a	1.93 ^b	1.96 ^b	2.14 ^a

^{ab}Means bearing different superscripts along the same column within a subclass differ significantly (P<0.05)

2.3. Slaughter operations

Animals were exsanguinated according to halal procedure, which is the accepted practice in the study area. After bleeding, the animals were partially skinned in a dorsally recumbent manner. Thereafter, they were suspended by the Achilles tendon on a 14cm wide gambrel for further skinning and evisceration.

The head was removed at the atlanto-occipital joint and the fore and hind feet removed at the carpal and tarsal joints, respectively. The carcasses were then split along the vertebral column into two halves.

2.4. Tissue separation

The left halves of the carcasses were cut into primal joints and each joint was dissected into lean fat and bone in line with the standard procedures of goat carcass evaluation (Colomer-Rocher *et al.*, 1987). Weights of each dissectible tissue from the primal joints were summed to obtain their total weight in the half carcass. The weight of each dissectible tissue as a proportion of the weight of the half carcass and the ratio of lean:bone were determined.

3. Results

Carcass tissue composition of the experimental animals according to breed and age are shown in Table 1. Percent carcass fat was not significantly affected by any of the factors under consideration. Breed and its interaction with age had significant effect on proportions of lean and bone and on lean:bone ratio ($P<0.05$). Age influenced percent bone and lean: bone ratio ($P<0.05$).

4. Discussion

4.1. Carcass lean

Considering that the Sahel is larger in mature size than the Sokoto Red (Ngere *et al.*, 1984; FDLPCS, 1992), the significantly higher proportion of lean in Sokoto Red goats could be attributed to the differences in mature size. Attwood (2002) reported that at any given age animals of large mature size have less lean than animals of smaller mature size, reasoning that at similar ages small-sized goats are closer to their mature weight than large sized-ones. Mean percent carcass lean for all goats was 64.6 % (Fig. 1). This value is within the range of 63-66% reported for various American goat genotypes (Dhanda *et al.*, 2003) and is close to the 64.5% of Simela *et al.* (1999) for Matabele goats. Although the effect of age on percent lean was not significant ($P>0.05$), the numerically higher percent lean in mature goats was earlier reported (Gaili *et al.*, 1972; Ruvuna *et al.*, 1992; Awah and Adeleye, 1994). Significant effect of breed x age interaction on percent lean (Fig. 2) implied that young goats of both breeds had comparable percent lean, while mature Sokoto Red goats had more lean than mature Sahel. Possible causes of this interaction maybe found in differences in growth rate and mature sizes of the two breeds. The Sokoto Red being closer to its mature size must at maturity be physiologically older and hence near to its maximum lean tissue accretion.

4.2. Carcass bone

The Sahel goats had significantly higher carcass bone ($P<0.05$) than their Sokoto Red counterparts. Significant breed effects in percent bone were earlier reported by Johnson *et al.* (1995) and Ruvuna *et al.* (1992). The observed non-significant difference in carcass bone percentage of young and mature goats might have resulted from concomitant increases in carcass lean and bone with age. The finding agreed with Abebe (2000) and Kadim *et al.* (2004). Lack of purposeful selection of the animals for meat production, as noted by Kadim *et al.* (2004) may be responsible. This equally applies to the breeds under study. Lower percent carcass bone in mature goats agreed with many earlier reports (Gaili *et al.*, 1972; Ruvuna *et al.*, 1992; Awah and Adeleye, 1994; Abebe, 2000).

Mean percent carcass bone observed for all experimental animals was 31.95%. This value was higher than the values reported for meat goats in the USA (Dhanda *et al.*, 2003), but lower than the percent bone (37.17%) in Polish ennobled race of goats (Korzeniowski *et al.*, 1988). Significant breed x age interaction effect was observed in percent carcass bone such that mature Sokoto Red goats recorded a much lower percent carcass bone than their Sahel counterparts (Fig. 3).

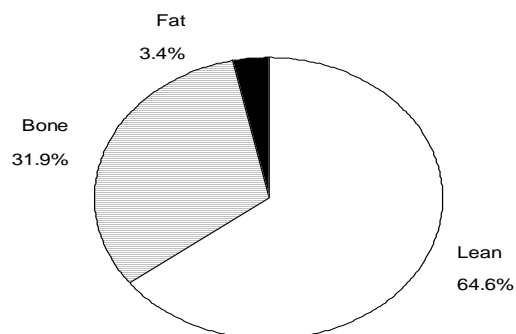


Fig. 1. Relative proportions of carcass tissue components.

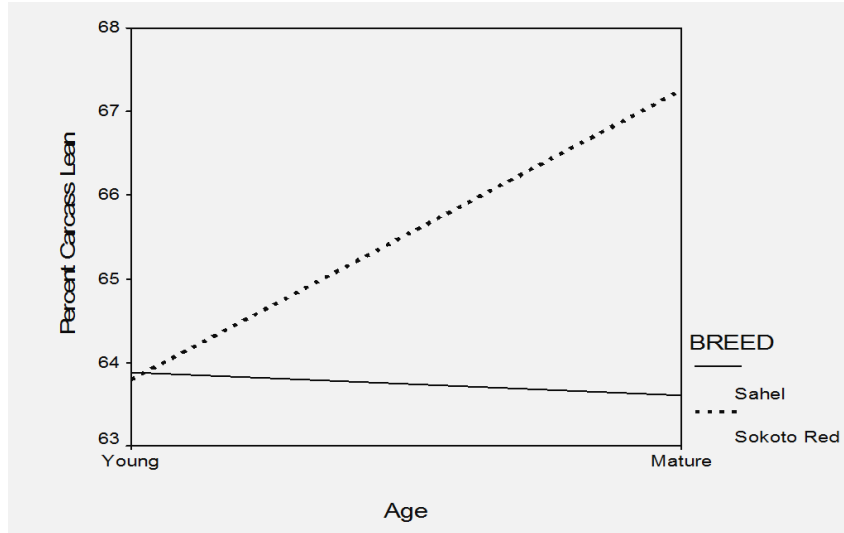


Fig. 2. Breed x Age interaction for carcass lean.

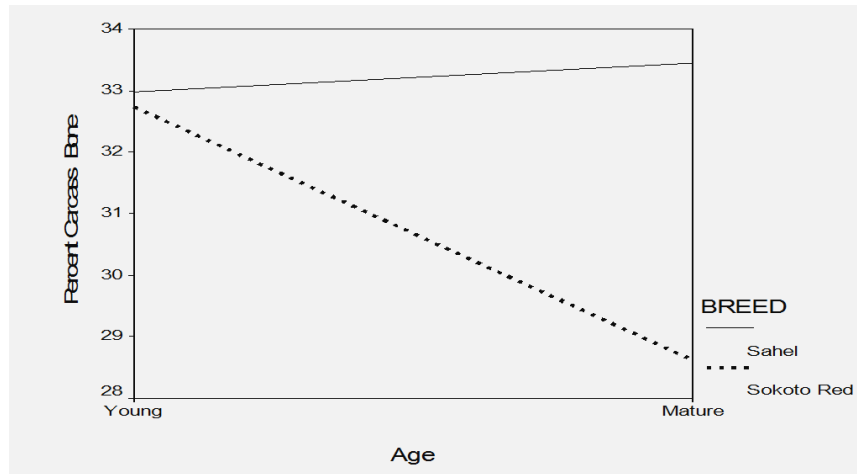


Fig. 3. Breed x Age interaction for carcass bone.

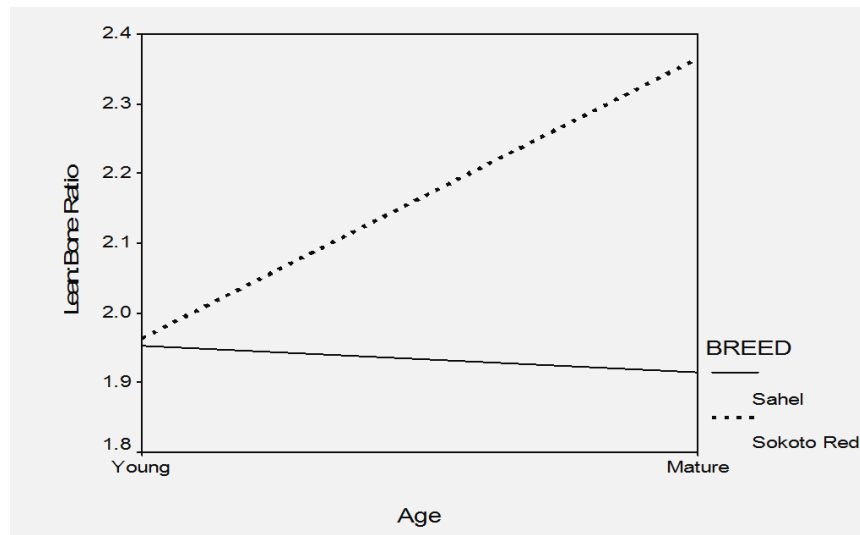


Fig. 4. Breed x Age interaction for lean:bone ratio.

4.3. Carcass fat

The effects of breed and age were not significant ($P>0.05$). The absence of differences in percent carcass fat between Sokoto Red and Sahel goats may suggest some similarity of the management system under which they are kept, as fat content of carcasses is to a large extent influenced by nutrition (Devendra, 1988).

Overall mean carcass fat was 3.42% (Fig. 1). The absence of breed effect on the proportion of carcass fat agreed with the findings of El-Bayoumi and El-Sheik (1989) and that of Nagpal *et al* (1995), while contradicting those of Ruvuna *et al.*, (1992) and Johnson *et al.*, (1995). However the higher value of carcass fat observed in mature goats was in consonance with some earlier findings (Gaili *et al.*, 1972; Ruvuna *et al.*, 1992; Awah and Adeleye, 1994; Abebe, 2000). Lack of significant age effect on carcass fat was in concordance with Kadim *et al.* (2004), but in disagreement with Abebe (2000).

4.4. Lean to bone ratio

Overall Mean lean: bone ratio was 2.05. The ratio was significantly higher in Sokoto Red than in the Sahel ($P<0.05$). Attwood (2002) observed that animals of large mature size have less lean or lean: bone ratio than animals of small mature size. Higher proportion of lean and lower bone percent in the Sokoto Red resulted in the higher lean: bone ratio of the Sokoto Red as compared to the Sahel. Breed x age interaction was significant ($P<0.05$) Figure 4 showed significantly ($P<0.05$) higher lean: bone ratio in mature Sokoto Red goats than in the young ones (2.14 vs 1.96) ($P<0.05$). This observation agreed to the reported trend of increasing proportion of lean and decreasing proportion of fat with advancing age in carcasses of meat animals (Forrest, 1975). The significantly higher lean: bone ratio of mature goats had been earlier reported (Gaili, 1972; Ruvuna, 1992; Awah and Adeleye, 1994; Abebe, 2000). The finding of the present study attested to ESMGPA (2005), where low lean: bone ratio was associated with low slaughter weight and young age. Carcasses of Sokoto Red goat had significantly more lean, less bone, higher lean: bone ratio than the Sahel. Carcasses of mature had higher lean: bone ratios.

5. Conclusion

- Breed x Age interaction plays an important role in determining carcass composition of goats.
- Goat carcasses have very little dissectible fat.
- On account of its having more lean, less bone and higher lean:bone ratio the Sokoto Red goat deserves more patronage.
- Mature goats should be preferred to young ones on account of their larger lean:bone ratio.
- The Sokoto Red goat, being the most preponderant breed in Nigeria and having shown some promise for better fleshing might be investigated more closely for its genetic merit as a meat animal.

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