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Research Article

Testicular and Body Morphometric Traits of Mature Rams of Djallonke and Ouda Breeds Reared in North Benin

Koutinhouin G. Benoît[1], Tougan Polycarpe Ulbad[1,2*], Boko K. Cyrille[3], Douada I-H[2], Zannou M. Serge[4], Aholou A. B. Raoul[1], Beckers Yves[6], Hanzen Ch[5], and Thewis André[6]

[1]Research Unit of Animal Husbandry and Meat Products Quality Control of Animal Production and Health Department; [3]Department of Animal Production and Health, Polytechnic School of Abomey-Calavi, 01 BP 2009, Cotonou, Republic of Benin, Benin; [2] Faculty of Agronomy (FA), University of Parakou, Republic of Benin; [4]Regional Excellence Centre of Avian Sciences of the University of Lome, BP 1515, Lome, Republic of Togo.
[5]Service de Thériogénologie, Département clinique des animaux de production, Faculté de Médecine Vétérinaire Université de Liège; [6]Animal Sciences Unit, Gembloux Agro Bio Tech, University of Liege, ULg-Gx ABT-Passage des Deportés, 2-5030, Gembloux, Belgium
***Corresponding author:** ulcaless71@yahoo.fr (Dr. Tougan Polycarpe Ulbad)

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ABSTRACT

The study aims to compare the testicular and body morphometric traits of Djallonke and Ouda sheep breeds reared on natural pasture in Benin. Data on testicles and body morphometric parameters were collected on 70 mature rams at 12 months of age, including 45 Djallonke rams and 25 Ouda rams, from January 2015 to September 2016. These data were analyzed with SAS software (2006). It comes out from this study that Ouda rams were significantly heavier ($P<0.001$) than Djallonke rams at 12 months old. In the same way, the head length (19.29cm) and whither's height (57.39 cm) of Ouda Sheep were higher ($P<0.01$) than those of Djallonke sheep (17.92cm and 53.9 cm). Nevertheless, the scapulo-ischium length and chest circumference were similar ($P>0.05$) for both sheep breeds. However, the Djallonke sheep had presented the lower values of shoulder width and pelvis length (19.22 cm *vs* 22.61cm).
The scrotal length was significantly affected ($P<0.01$) by the sheep breed with the weakest value (13.73 cm) recorded within Djallonke sheep breed comparatively to Ouda rams (15.01 cm). In the same way, the scrotal circumference, paired testes weight, mean testes length, testes diameter and mean testes volume varied significantly ($P<0.001$) according to the sheep breed with the highest values observed in Ouda sheep.

Key words: Breed, Sheep, Testis, Morphometric traits, Variability

INTRODUCTION

Sheep production is a widthspread activity in Benin, as in most countries in sub-Saharan Africa (Gbangboché *et al.,* 2005a, SWAC-OECD / ECOWAS 2008; Babatunde *et al.,* 2010). As ruminants, they play a very vital role in the livelihood of rural populations as sales of the animals and their products help to stabilize household income. Djallonke and Ouda breeds are the main sheep breeds met in Benin with a predominance of Djallonke breed (Gbangboche *et al.,* 2004) because of its perfect adaptation to the local climatic conditions and its resistance (Mawuena 1987; Gbangboché *et al.,* 2005a, Gbangboché *et al.,* 2005b).

The West African Dwarf sheep of Djallonke breed is a hairy sheep breed found all over West and Central Africa of 14° south latitude. The characteristics of WAD sheep have been described by several authors (Rombaut, 1980; Pagot, 1985; Larrat, 1989; Fournier, 2006; Gbangboché *et al.,* 2005). It is a compact breed with a small mature size and short horizontal lop ears. Coat colour varies from spotted black and white to solid black or white. Some have tan or brown coat colour and black bellies. Rams are horned and females usually polled. WAD sheep are capable of limiting parasite multiplication and remain productive in tsetse-infested areas where other breeds can't survive without treatment (Ayuk *et al.,* 2014). However, West African dwarf sheep have low productivity (Yapi, 1994) and weak reproduction and growth performance (Adjibodè, 2012) varying with latitude from north to the south of Benin (Gbangboché *et al.,* 2005b; Youssao *et al.,* 2008).

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Found in northern Nigeria, southern Niger, Northern Benin, central TC had, northern Cameroon and western Sudan, the Ouda sheep breed is one of the hair sheep breeds of the Sahel type (Mason, 1996). It is a meat breed with distinctive markings. The front half of the body is black or brown and the back half is white. The rams of the Ouda are horned and the ewes are usually polled. When compared to the West African Dwarf, the main difference is that the Sahel-type sheep are taller, heavier, of poor mutton conformation and rams do not have a throat ruff or mane. The Sahel-type are usually white, white and brown, or white and black with lop ears. The males display a long twisting pattern to the horns and the females are usually polled. It is adapted to extensive grazing and survival under hot and dry environment. In general, the Ouda sheep inhabit the semi-arid mono-modal rainfall lowlands and adjoining arid areas of southern Niger, northern Benin, northern Nigeria, central Chad, western Sudan and parts of Cameroon. It does not survive well outside its ecological zone.

Due to their relative simplicity compared to the rearing of large animals (Vallerand and Blanckaertr, 1975; London and Weninger, 1996), sheep rearing in Benin increase over the years with a national herd increasing from 690,000 heads in 2003 to 860,000 heads in 2013 (County Stat, 2016).

However, the productivity of those sheep breed in Benin is low (Gbangboché *et al.*, 2005b; Youssao *et al.*, 2008), amongst others, due to a low fertility rate in the breeding herds. Thus, to keep up with the increasing demand of meat production and the productivity of sheep, there is a need for sustainable improvement strategies. Improvement of sheep reproductive performance requires effective actions on its various components, with prolificacy being one of the most important (Yakubu and Musa-Azara, 2013) such as body and gonads morphometric traits.

Morphometric traits are continuous parameters describing aspects of animal body conformation (Riva *et al*., 2004; Cervantes *et al*., 2009) and are an essential component of breed characterization (Gizaw *et al.*, 2007). Morphological parameters such as chest circumference, wither's height and scapulo-ishium length can be used for rapid selection of large size animals for constitution of elite herds (Dossa *et al.*, 2007). Variations in morphometric traits between different sheep populations can provide a soundness basis for livestock management.

Few studies (Gbangboché *et al.*, 2004; Akouedegni *et al.*, 2013; Awohouedji *et al.*, 2013) are carried on the morphometric characterization of sheep breeds reared in Benin. Testicular measurements and live weight were reported to generally indicate the production of viable spermatozoa by the male (Agga *et al.*, 2011). The morpho-biometrical analysis of testicular development is of great importance since it is significantly correlated with reproductive activity (Emsen, 2005).

The aim of this study was to compaare the body and testicular morphometric traits of Djallonke and Ouda sheep breeds reared under traditional sheep breeding in Benin.

MATERIALS AND METHODS

Study area

The study was thus conducted in the department of Borgou in the North of Benin. Situated between the latitudes of 6°20' and 12°30' north and between the longitudes of 1°30' and 3°45 East, the republic of Benin covers an area of 113440 km^2 with a population of 10448647 inhabitants (INSAE, 2015) and a density of 60 hab/km^2.

The department Borgou exhibits climatic conditions of Sudan type, characterized by only one rainy season (from April to October) and one dry season (November to March). Average rainfall varies between 900 and 1300 mm per year while the average annual temperature is 26°C with a maximum of 32°C in March and a minimum of 23°C from December to January. The relative humidity varies between 30 and 70%. Vegetation of Borgou department is a diversified savannah where tree density decreases towards the North.

Data collection

Data on testicles and body morphometric parameters were then collected on 45 Djallonke rams and 25 Ouda rams of 12 months old, from from January 2015 to September 2016. These animals were all raised in a traditional system. Feeding was mainly based on natural pasture. The animals were put on pasture at about 7.30 a.m. and returned to the barns in the afternoon. They were then fed *ad libitum* a supplementary diet consisting of crop residues according to the traditional system. The sheep were treated for ectoparasites, drenched once every three months and given other veterinary attention when the need appeared.

Reproductive tracts of those 70 matured rams of 12 months old were obtained after slaughter within the department of Borgou in the North of Benin. The reproductive tracts were then immediately brought to the laboratory covered in ice and were processed on the same day.

The material used for data collection was composed of a data file for recording the testicular and body morphometric traits and usual morphometric traits recording materials.

The body weight of the rams was recorded using a scale of 40 kg of capability and 20g of accuracy. Scrotal circumference was measured using a tape at the broadest part of the scrotum. Shoulder width was determined with the aid of a tape measure, as the horizontal distance between the processes on the left shoulder and those of the right shoulder blade. Chest circumference was measured by using a measuring tape around the chest, just behind the front legs; body length was measured from the sternum to the aitch bone and hip or pelvis width was measured using a plastic measuring tape, while height at wither was measured vertically from thoracic vertebrae to the ground using a metal ruler.

The epididymis was carefully excised from the testis along the physiological joints. The testes and epididymis was separated free of adhering connective tissues and fats before the records of morphometric parameters. The following parameters were taking: Testicular length, Testicular diameter, Testicular volume, Testicular weight, Epididymal weight.

Testicles length was measured with the use of flexible tape in cm; testicles diameter was taken with the use of Vernier caliper; testicle volume was measured by the use of water displacement technique according to Alexandrou

(2001). Testicular and Epididymal weights were recorded in grams with the use of digital weighing balance. Also, the testicular density was obtained by dividing the testicular weight by the testicular volume as the following formula:

Testicular density ($g.cm^{-1}$) = Testes weight (g)/Testes volume (cm^3)

Statistical analysis

Data collected were analyzed for the effect of breed (Ouda and Djallonke) using the software Statistical Analysis System (SAS, 2006). Student t-test and the one way analysis of variance (ANOVA) analysis were done. The mathematical expression of this model is as follows:

$Y_{ij} = \mu + E_i + e_{ij}$

Where
Y_{ij}: the morphometric parameter of the animal j, of the breed i (Ouda or Djallonke);
μ: overall mean;
E_i: fixed effect of breed i (Ouda or Djallonke);
e_{ij}: Effect of random residual average performance of the animal j, of the breed i (Ouda or Djallonke).

RESULTS

Variability of body morphometric parameters in Djallonke and Ouda Sheep reared in Benin

The table 1 show the variability of body morphometric parameters in Djallonke and Ouda Sheep reared in Benin. It appears that Ouda rams were significantly heavier (P<0.001) than Djallonke rams at 12 months old. In the same way, the head length (19.29cm) and whither's height (57.39cm) of Ouda Sheep were higher (P<0.01) than those of Djallonke sheep (17.92cm and 53.9cm). Nevertheless, the scapulo-ischium length and chest circumference were similar (P>0.05) for both sheep breeds. However, the Djallonke sheep had presented the lower values of shoulder width (14.66 cm *vs* 15.632cm) and pelvis length (19.22 cm *vs* 22.61cm).

Variability testicular measurements in Djallonke and Ouda Sheep reared in Benin

The variability of testicular measurements parameters in Djallonke and Ouda Sheep rered in Benin is given in table 2. The scrotal length was significantly affected (P<0.01) by the sheep breed with the weakest value (13.73cm) recorded within Djallonke sheep breed comparatively to Ouda rams (15.01cm). In the same way, the scrotal circumference, paired testes weight, mean testes length, testes diameter and mean testes volume varied significantly (P<0.001) according to the sheep breed with the highest values observed in Ouda sheep. The paired epididymal weight and mean epididymal length of Ouda rams (29.21g and 21.12cm respectively) were significantly higher (P<0.001) than those of Djallonke breed (25.79g and 18.64cm respectively). Similarly, the mean epididymal volume of Djallonke sheep was 14.76ml to 16.62ml for Ouda breed (P<0.01). However, the mean testes density and the mean epididymal density of the both sheep breeds didn't vary significantly according to the breed (P>0.05).

DISCUSSION

Variability of body morphometric and testicular traits in Djallonke and Ouda Sheep breeding in Benin

Our results on measured body and testicular traits showed that the West African Dwarf (WAD) Sheep of Djallonke breed is a small format sheep breed comparatively to Ouda breed which is the heavier. Similar result was presented by Otoikhian (2008) and Okpeku *et*

Table 1: Variability of body morphometric parameters in Djallonke and Ouda Sheep breeding in Benin

Variables	Djallonke		Ouda		Breed effect
	Mean	SE	Mean	SE	
Live Weight (kg)	20.18	0.70	25.18	0.51	***
Head length (cm)	17.92	0.33	19.29	0.34	**
Whither's height (cm)	53.90	0.83	57.39	0.94	**
Scapulo-Ischium length (cm)	60.12	0.73	61.53	0.58	NS
Chest Circumference (cm)	70.82	1.02	71.70	0.86	NS
Shoulder or Back width (cm)	14.66	0.28	15.63	0.24	*
Pelvis length (cm)	19.22	0.58	22.61	0.47	***

SE: Standard Error, NS: P>0.05; *: P<0.5; **: P<0.01; ***: P<0.001.

Table 2: Variability testicular measurements in Djallonke and Ouda Sheep breeding in Benin

Variables	Djallonke		Ouda		Breed effect
	Mean	SE	Mean	SE	
Scrotal length (cm)	13.728	0.266	15.012	0.346	**
Scrotal circumference (cm)	21.41	0.607	24.514	0.447	***
Paired testes weight (g)	279.13	6.53	318.36	5.4	***
Mean testes length (cm)	6.303	0.148	7.143	0.134	***
Testes diameter (cm)	4.395	0.102	4.9857	0.0933	***
Mean testes volume (ml)	133.28	3.14	151.27	2.82	***
Mean testes density (g/cm^3)	1.0492	0.00598	1.0471	0.00485	NS
Paired epididymal weight (g)	25.785	0.602	29.214	0.508	***
Mean epididymal length (cm)	18.644	0.435	21.121	0.367	***
Mean epididymal volume (ml)	14.767	0.366	16.621	0.445	**
Mean epididymal density (g/cm^3)	0.8782	0.0153	0.8857	0.0143	NS

SE: Standard Error, NS: P>0.05; **: P<0.01; ***: P<0.001.

al. (2011). According to these authors, the Ouda, Balami and Yankasa sheep breeds are heavier than the WAD sheep. Several authors concluded, that the genotype or the breeds of sheep reared under comparable conditions have frequently different age-type weight and average daily gains (Gbangboche 2005a; Doko Alou *et al.,* 2013). These authors linked it to several factors including the genetic type and natural selection (Lebbie and Ramsay, 1999; Gbangboche, 2005b; Youssao, 2008). This reality is highlighted by the results of our study which show that Ouda rams were significantly heavier than Djallonke Dwarf rams. This is in agreement with the report of Osinowo *et al.* (1989) and Otoikhian (2008). It was also observed that the variation in phenotypic traits of the studied sheep breeds found in Benin is relatively high. This is a good potential to explore for genetic improvement programmes for Benin native sheep breeds.

Poivey *et al.* (1982) reported high heritability for weight at three months of age and suggest taking this into account in the selection of dwarf sheep. It is therefore proven that the crossbreeds Sahelian x West African dwarf sheep express best growth performances than pure Djallonke breed (Amégé, 1984) and could be perceived as an alternative of improvement of the profitability of sheep rearing (Gbangboché *et al.,* 2002). Thus, the crossing between Djallonke sheep and Ouda sheep breeds can improve the growth performances of Djallonke sheep and preserve their resistance to disease.

The weights obtained at the 12th month old in Djallonke and Ouda rams are lower than the value of 30kg obtained by Amégé (2004) for Vogan sheep at 7 months old and the live weight of 37.3kg reported for Lohi sheep of 9 months old by Lashari and Tasawar (2010). These confirm that the growth performances of the sheep breeds reared in Benin have relatively very low growth performance and need improvement program, since body size is generally important parameters used in breeding soundness evaluation. Knowing the body weight of an animal is important for a number of reasons such as breeding, correct feeding, health matters, growth as well as classification.

In the same way, the head length and whither's height of Ouda Sheep were significantly higher than those of Djallonke sheep. However, the scapulo-ischium length and chest circumference were similar in the both sheep breeds in our study. The Djallonke sheep had also presented the lower values of shoulder width and pelvis length.

The variation of morphometric measurements observed herein according to the ecotype with the highest values of all measured parameters found in sheep of Ouda breed is in accordance with the report of Salako and Ngere (2002). Similar result was also reported by Traore *et al.* (2008) between the Sahelian and Sudan- Sahelian (Mossi) sheep of Burkina-Faso where Sahelian sheep had longer tail than Mossi sheep. According to FAO (2005), the characterization of body measurements of the Djallonke sheep presents great variability according to the latitudes and mediums of breeding.

Variability testicular measurements in Djallonke and Ouda Sheep reared in Benin

The testicular morphometric parameters in Djallonke and Ouda Sheep are given in table 2. It come out from this table that, the scrotal length was significantly affected by the sheep breed with the weakest value recorded within Djallonke sheep breed comparatively to Ouda rams. In the same way, the scrotal circumference, paired testes weight, mean testes length, testes diameter and mean testes volume varied significantly according to the sheep breed with the highest values observed in Ouda sheep. The paired epididymal weight and mean epididymal length of Ouda rams were significantly higher than those of Djallonke breed. Similarly, the mean epididymal volume of Djallonke sheep was 14.76 ml to 16.62 ml for Ouda breed. This finding confirms the result of Ibrahim *et al.* (2012) who observed that the scrotal circumference of Uda was significantly higher than of the Balami and Yankasa, but there had no significant difference between Balami and Yankasa breeds. Similar reports of differences between breeds were earlier reported in goats (Raji *et al.,* 2008) and cattle (Abassi, 2011; Addass, 2011). According to these authors, these differences could be due to the effect of genotype or breed. Nevertheless, the means of scrotal circumference of Ouda breed obtained herein was higher than the value of 21.50 ± 0.61, reported by Ahemen and Bitto (2007) for West African dwarf rams but similar with the value recorded in Djallonke rams. Scrotal circumference is measured as it gives a good indication of rams breeding ability. Schoenian (2011) reported that ram lamb with scrotal circumference of less than 30 cm and adult rams with scrotal circumference of less than 32 cm should probably not be used for breeding. Similarly, Söderquist and Hultén (2006) reported that for mature rams (17 - 54 months old), the mean scrotal circumference was 34.4 ± 2 cm in Gotlandie breed, and 34.5 ± 0.9 cm for Dorper ram by Besta.

The differences found in testes size could be due to the effect of breed. Similar reports of differences between breeds were earlier reported in goats (Raji *et al.,* 2008) and cattle (Abassi, 2011; Addass, 2011).

Testes weight, a soundness index of semen producing ability had been found to depend on the breed in the current study. The results observed herein are similar to those found in other breeds of sheep within the tropics and sub-tropics, but significantly higher than the values varying between 134.48 g and 154 g as reported for WAD rams and Kajli rams in Nigeria and Pakistan by Ahemen and Bitto (2007) and Siddiqui et al. (2005) respively.

Moreover, it was reported that males with larger testes tend to sire daughters that reach puberty at an earlier age (Söderquist and Hultén, 2006). Brito *et al.* (2004) have reported that heavier testes produce more spermatozoa than the smaller testes in breeding animals. The significant higher testes weight of sheep Ouda found in our study would mean that those testes could contain more seminiferous tubule, interstitial endocrine cells and possibly more spermatozoa than the Djallonke breed. The variation in the testes volume for the different breed observed in this study agrees with the report of Ibrahim (2012) in different strains of chicken.

Conclusion

The study revealed that chest circumference, back width, pelvis length, paired testes weight, mean testes length, testes diameter, mean testes volume, mean testes density, paired epididymal weight, mean epididymal

length, mean epididymal volume and the mean epididymal density depend on the sheep breed with the best testicles size recorded in Ouda sheep. Further study must be carried out on the variability of semen quality of those sheep breeds reared in Benin.

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