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Testicular abnormalities of rams in two slaughterhouses in Sokoto, Nigeria

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Abstract

This study was designed to determine the testicular abnormalities in rams slaughtered in Sokoto, Nigeria. The testicles of rams presented for slaughter were examined, and the age, breed, position, and sites of testicular abnormalities were noted. Out of 638 rams examined, 3 had testicular abnormalities, representing a prevalence of 0.47%, comprising 2 (0.31%) unilateral cryptorchidism and 1 (0.16%) unilateral hypoplasia. The prevalence of (0.58% (2/342) and 0.34% (1/296) were obtained at the Sokoto metropolitan abattoir and Batta Shuni slaughter slab, respectively. Two (0.31%) of the rams with abnormality were 1 < - ≤ 2 years old, comprising 1(0.16%) cryptorchid ram and testicular hypoplasia. There was 1 (0.16%) ram 2 < - ≤ 3 years with testicular hypoplasia. Based on breed, there was 1(0.16%) each of Yankasa, crosses (cryptorchidism) and Uda (testicular hypoplasia). The abnormalities were all on the right testis, while one cryptorchid testis each was in the subcutis and abdomen. There was a significant ($p < 0.05$) decrease in the testicular weight and mid-testicular circumference of the abnormal testis compared to the normal. The longitudinal length of the abnormal testis was smaller than the normal, although this was not significantly ($p > 0.05$) different. There was atrophy of the seminiferous tubules with a poorly developed tubular lumen in the cryptorchid ram. In addition, the epididymis was devoid of spermatogenic cells. The hypoplastic testis had reduced spermatogenic activity and slight testicular degeneration which were absent in the normal testis. The study shows that rams with testicular abnormalities are rare among rams slaughtered in Sokoto although those with abnormalities may be infertile, rendering them unfit for breeding.

Keywords: Cryptorchidism, Infertility, Ram, Testicular abnormalities, Testicular hypoplasia

Introduction

The sheep is a cloven-footed ruminant animal belonging to the kingdom Animalia, phylum Chordata, class *Mammalia*, order *Artiodactylia*, family *Bovidae*, and subfamily *Caprinae* genus *Ovis*, Species *Aries* (Muigai & Hanotte, 2013). The sheep population of Nigeria is estimated to be 37.4 million, with a large population in the northern part of the country (NASS, 2011), where they play a significant role in the socio-economic life of most families, especially during festive periods like the *Eld-el Kabir*, weddings, and naming ceremonies (Umaru *et al*., 2009). They are essential in supporting low-income families, particularly in rural areas with milk and meat (Yakubu *et al*., 2010). The Yankasa, Balami, West

African Dwarf (WAD) and Uda are the major breeds of sheep indigenous to Nigeria (Blench, 1999). The Yankasa are the most numerous breeds of sheep found in the Guinea savanna region of Nigeria (Lawal-Adebowale, 2012). The Balami are found in the semi-arid north, while the WAD is mostly restricted to the southern part (Blench, 1999). However, the Uda breed is found in Nigeria's north and middle belt (Yakubu *et al*., 2010).

There are several limitations to sheep production in Nigeria, such as diseases, poor feeding, substandard management practices and unwholesome breeding policies (Oladele *et al*., 2013). In addition, the reproductive abnormality is a major limitation to livestock production due to the economic impediment to the farmer (Wekhe & Yahaya, 1999). This is due to poor semen quality that renders the male unfit for breeding (Igbokwe *et al*., 2014; Oguejiofor *et al*., 2018: Onugwu *et al*., 2018). Intersexuality, cryptorchidism, poor libido, testicular hypoplasia, phimosis, paraphimosis, orchitis, testicular atrophy, and scrotal laceration have been reported among bucks, bulls and boar in Nigeria (Wekhe & Yahaya, 1999; Mshelbwala & Igbokwe, 2010; Igbokwe *et al*., 2011; Adeyeye & Wakkala, 2013a; Adeyeye & Wakkala, 2013b; Abba *et al*., 2014). Prevalence rates of testicular abnormalities ranging from 3.8% to 70% have been reported in Nigeria (Wakkala, 2012; Abba *et al*., 2014), Algeria (Bousmaha & Khoudja, 2012) and Cameroon (Kouamo & Nyonga, 2022). The 70% prevalence was for cryptorchidism and was reported among the West African Dwarf bucks of southeastern Nigeria, where inbreeding is practised due to the local belief that they have a better sex drive (Emehelu *et al*., 2005; Uchendu *et al*., 2015).

Apart from Olusa *et al*. (2016), who reported concurrent unilateral cryptorchidism with a scrotal and inguinal hernia in the West African dwarf sheep, there is no report on any testicular abnormalities of sheep in Nigeria to the best of our knowledge. This is despite being the genital organ most predisposed to reproductive abnormality (Kouamo & Nyonga, 2022). Therefore, this study was designed to determine the testicular abnormalities of rams in two slaughterhouses in the Sokoto metropolis.

Materials and Methods

Study area

The study was carried out at the Sokoto metropolitan abattoir and the Batta Shuni slaughter slab (about 12.5 km from Sokoto town) from February to June 2018.

Study design

The testicles of rams at slaughter were examined, while their age, breed and location of the testicular abnormalities were noted. The age of the rams was determined using rostral dentition, while their colour coat and body markings were used to determine their breed. Their testes were examined before slaughter by palpation. Those with evidence of testicular abnormalities were further examined after slaughter and flaying. Abnormal testes were collected and transported to the Theriogenology Laboratory, Faculty of Veterinary Medicine, Usmanu Danfodiyo University. At the Laboratory, their weights were measured using an electronic scale (Golden-Mettler USA) calibrated in grams. The testicular length and mid-circumference were determined using a thread and meter rule. In addition, their corresponding normal testes were collected to compare with the abnormal. Sections from both normal and abnormal testes were placed in Bouin's solution for histological examination.

Data analysis

Data were entered into GraphPad Prism (2013) and analyzed using descriptive statistics and a student t-test. Results are presented in tables, while histological slides are presented in plates.

Results

Out of 638 rams examined (342 from the Sokoto metropolitan abattoir and 296 from the Batta Shuni slaughter slab), 3 had testicular abnormalities, representing a prevalence of 0.47%. The prevalence of 0.58% and 0.34% were observed at the Sokoto metropolitan abattoir and Batta Shuni slaughter slab, respectively (Table 1). The overall prevalence of unilateral cryptorchidism was 2 (0.31%), while unilateral hypoplasia was 1 (0.16%) (Table 2). Two (0.31%) rams with an estimated age of $1 < - \leq 2$ years had an abnormality. One was a cryptorchid and the

Table 1: Prevalence and type of testicular abnormalities in rams slaughtered in Sokoto, Nigeria

Location	Number examined	Number of testicular abnormalities	Prevalence (%)
Sokoto metropolitan abattoir	342	2	0.58
Batta Shuni slaughter slab	296	1	0.34
Total	638	3	0.47

Table 2: Type of testicular abnormalities in rams slaughtered in Sokoto, Nigeria (n = 638)

Type of abnormality	Number observed	Prevalence (%)
Unilateral cryptorchidism	2	0.31
Unilateral testicular hypoplasia	1	0.16

Table 3: Distribution of testicular abnormalities based on age, breed, location and position in rams slaughtered in Sokoto, Nigeria (n = 638)

	Type of abnormality		Number of abnormal testes	Prevalence
	Cryptorchidism	Testicular hypoplasia		
Age of ram (years)				
1 < - ≤ 2	1	1	2	0.31
2 < - ≤ 3	1	0	1	0.16
Breed of ram				
Yankasa	1	0	1	0.16
Cross	1	0	1	0.16
Uda	0	1	1	0.16
Position				
Right	2	1	3	0.47
Left	0	0	0	0.00
Location				
Subcutaneous	1	NA	1	0.16
Abdominal	1	NA	1	0.16

NA – Not applicable

other testicular hypoplasia (Table 2). There was 1(0.16%) ram 2 < - ≤ 3 years with cryptorchid testis. Based on breed, there were 1 (0.16) each of Yankasa, cross (cryptorchidism) and Uda (testicular hypoplasia). The abnormalities were all on the right testis, while one cryptorchid testis each was in the subcutis and abdomen (Table 3). There was a significant ($p < 0.05$) decrease in the testicular weight of the abnormal testes (74.5 ± 16.7g) compared to the normal (207.5 ± 8.7g). The mid-testicular circumference of the abnormal testes (9.2 ± 3.2cm) was also significantly ($p < 0.05$) reduced compared to the normal (18.0 ± 3.0cm). The longitudinal length of the abnormal testis (8.2 ± 2.5cm) was smaller than the normal (12.4 ± 2.5cm). However, this was not significant ($p > 0.05$) (Table 3). The histology of the cryptorchid testis revealed atrophic seminiferous tubules with a poorly developed tubular lumen (Plate I), and the epididymis was devoid of spermatogenic cells (Plate II). The histology of the hypoplastic testis is presented in Plate III. There was reduced spermatogenic activity and slight testicular degeneration. However, the other testis had normal histology (Plate IV).

Table 4: Morphometry of the abnormal testis of ram slaughtered in Sokoto, Nigeria

	Abnormal testis	Normal testis
Testicular weight (g)	74.5 ± 16.7^a	207.5 ± 8.7^b
Mid-testicular circumference (cm)	9.2 ± 3.2^a	18.0 ± 3.0^b
Longitudinal length (cm)	8.2 ± 2.5	12.4 ± 2.5

Values within rows with different superscripts differ significantly ($p < 0.05$)

Discussion

The prevalence of testicular abnormalities in the present study is lower than the 3.8%, and 19.3% reported in bulls slaughtered at the Sokoto metropolitan abattoir (Wakkala, 2012) and northern Cameroon (Kouamo & Nyonga, 2022), respectively. It is also lower than the 8.4% reported among rams slaughtered at the Tiaret abattoir, Algeria (Bousmaha & Khoudja, 2012) and 15.1% reported in Sahel bucks slaughtered at the Maiduguri metropolitan abattoir, Nigeria (Abba *et al*., 2014). The variation may be attributed to the difference in the location and the animal species involved. Most of the presentation of rams for slaughter at the slaughterhouses in Sokoto is done by roasted meat vendors who usually buy healthy rams in order to get returns for their

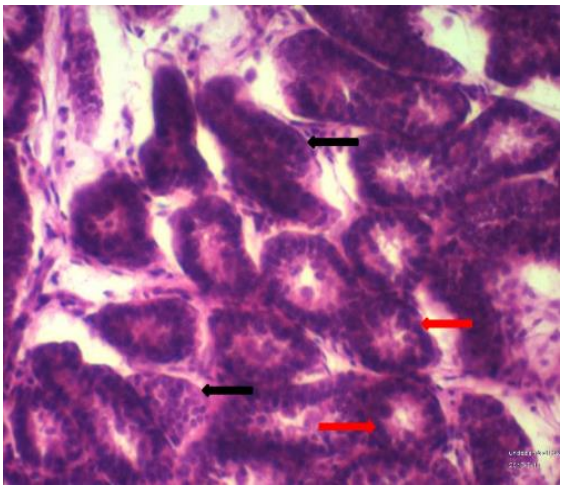

Plate I: Photomicrograph of a cryptorchid testis showing atrophic seminiferous tubules (red arrows) with a poorly developed tubular lumen (black arrows). (H & E × 40)

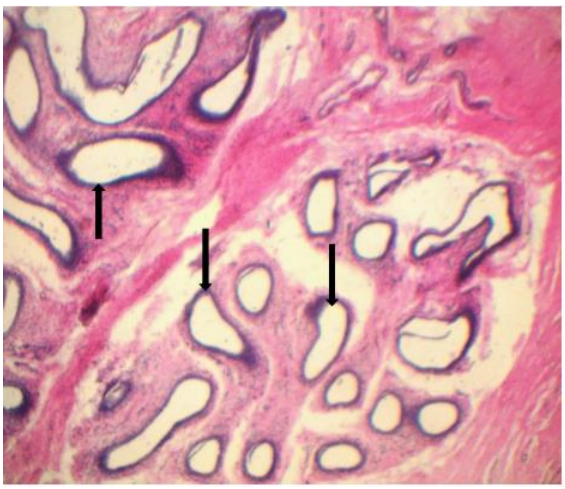

Plate II: Photomicrograph of the epididymis showing empty lumen devoid of spermatogenic cells (arrows). (H & E × 40)

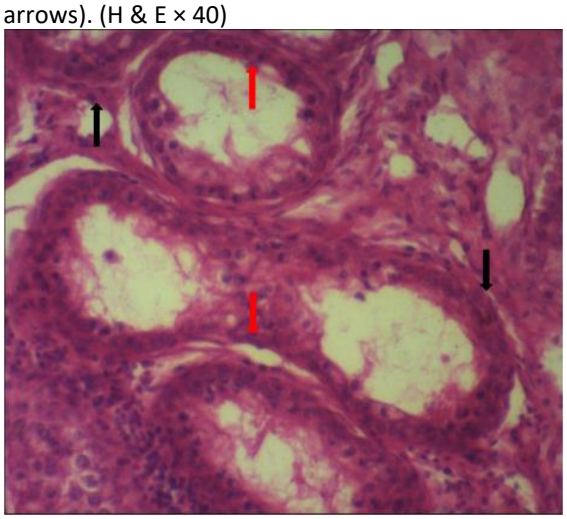

Plate III: Photomicrograph of the hypoplastic testis showing reduced spermatogenic activity (red arrows) and slight testicular degeneration (black arrows) (×100 H &E)

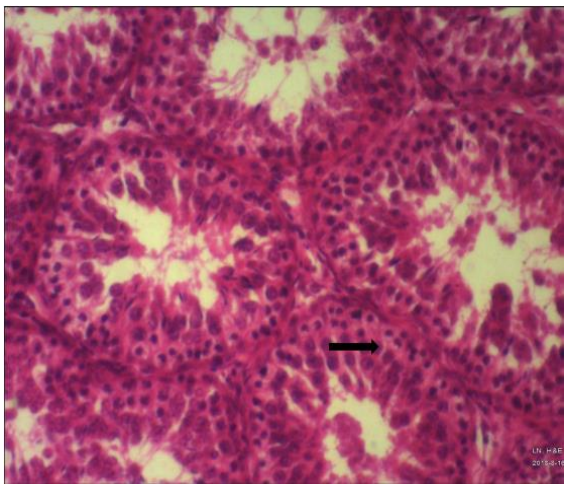

Plate IV: Photomicrograph of the normal testis showing seminiferous tubules with active spermatogenic activity (arrow). (× 100 H &E)

businesses. Most rams slaughtered for other purposes are often not brought to slaughterhouses where disorders such as testicular abnormalities can be detected. These may account for the low prevalence. Cryptorchidism and testicular hypoplasia were the types of testicular abnormalities seen during this study. This is contrary to reports in other studies where orchitis and testicular atrophy were also detected in rams (Regassa *et al*., 2003; Bousmaha & Khoudja, 2012), bucks (Regassa *et al*., 2003; Kafi *et al*., 2007; Abba *et al*., 2014) and bulls (Wekhe & Yahaya, 1999; Migbaru *et al*., 2014). Cryptorchidism and testicular hypoplasia are believed to be hereditary (Migbaru *et al*., 2014), unlike other testicular abnormalities that are acquired suggesting that factors that promote acquired abnormalities may be absent in Sokoto.

In the present study, the prevalence of cryptorchidism is similar to 1.8%-3.1%, 0.25%-2.1% and 0.63-3.1% reported in rams (Regassa *et al*., 2003; Bousmaha & Khoudja, 2012), bucks (Wekhe & Yahaya, 1999; Igbokwe *et al*., 2009; Bousmaha & Khoudja, 2012; Abba *et al*., 2014) and bulls (Wekhe & Yahaya, 1999; Adeyeye & Wakkala, 2013a; Migbaru *et al*., 2014), respectively. It is also similar to the reports of Adeyeye *et al*. (2020) in camel bulls. Similarly, the prevalence of testicular hypoplasia in the current study is comparable to the report of Bousmaha & Khoudja (2012) in rams in Algeria and in other ruminants in Nigeria (Wekhe & Yahaya, 1999;

Igbokwe *et al*., 2009; Adeyeye & Wakkala, 2013b; Abba *et al*., 2014). However, it is lower than the 17.0% reported by Kafi *et al*. (2007) among Iranian bucks. The hereditary nature of these testicular abnormalities suggests that they may have been caused by malnutrition during pregnancy, chromosome abnormalities and inbreeding. The age-specific prevalence in this study revealed that testicular abnormalities were seen in younger rams. This is consistent with the reports of Bousmaha & Khoudja (2012) and Regassa *et al*. (2003) on rams. It is also consistent with the reports of Mshelbwala & Igbokwe (2010) in Sahel bucks. However, it differs from previous reports on bucks (Kafi *et al*., 2007; Abba *et al*., 2014) and bulls (Adeyeye & Wakkala, 2013a; Adeyeye & Wakkala, 2013b; Kouamo & Nyonga, 2022). Cryptorchidism and testicular hypoplasia are congenital abnormalities that are often detected early. Therefore, their owners may decide to fatten the rams briefly before selling them for slaughter or fatten them for an extended period. This may account for the age distribution in this study. There was no breed-specific prevalence in the present study, probably due to the low prevalence of testicular abnormalities. This is similar to the findings of Regassa *et al*. (2003) in the ram and other ruminants (Mshelbwala & Igbokwe, 2010; Migbaru *et al*., 2014; Kouamo & Nyonga, 2022). All the testicular disorders in our study were right unilateral abnormalities similar to earlier reports in ram (Olusa *et al*., 2016) and buck (Igbokwe *et al*., 2009). However, it differs from earlier reports in the bull (Adeyeye & Wakkala, 2013a; Adeyeye & Wakkala, 2013b). The position of the testicular abnormalities suggest a preponderance of the right in small ruminants. The reasons for this are unclear but may be associated with the abnormal production of testosterone or the absence of Müllerian inhibiting hormones required for normal testicular descent (Mahmud *et al*., 2015). Among the cryptorchid rams, subcutaneous and abdominal testis were equally observed. This is contrary to the reports of Adeyeye & Wakkala (2013a) in bulls where a higher number were subcutaneous testis. The inconsequential difference in the present study may be attributed to the low number of cryptorchid rams observed.

The abnormal testes were smaller than normal, evident by the substantial decrease in their testicular morphometry. This is consistent with previous reports in ruminants with cryptorchidism (Igbokwe *et al*., 2009; Adeyeye & Wakkala, 2013a) and testicular hypoplasia (Igbokwe *et al*., 2011; Adeyeye & Wakkala, 2013b). However, it is inconsistent with the report of Adeyeye *et al*. (2020) on a camel with bilateral cryptorchidism. A reduction in the size of the abnormal testis is not unexpected since embryonic development may have been altered, giving rise to small organs. In the cryptorchid testes, there were atrophic seminiferous tubules with poorly developed tubular lumen, similar to previous findings in bucks (Igbokwe *et al*., 2009; Abba *et al*., 2014), bulls (Adeyeye & Wakkala, 2013a, Uyar *et al*., 2019) and a camel (Adeyeye *et al*., 2020) with cryptorchidism. It is also similar to the findings in bucks with testicular atrophy (Mshelbwala & Igbokwe (2010) and rabbits infected with *Trypanosoma brucei brucei* (Adeyeye *et al*., 2021). The atrophic seminiferous tubules may result from increased testicular temperature leading to disruption of tubular architecture. As the rams advance in age, there are possibilities of spermatogenic arrest that will render the animal infertile. The epididymis of the cryptorchid rams was devoid of spermatogenic cells. This is comparable to the reports of Igbokwe *et al*. (2011) in bucks with testicular hypoplasia, and Okubanjo *et al*. (2014) in ram experimentally infected with *Trypanosoma congolense*. The empty epididymal sperm reserves may have been caused by the extensive damage to the testicular tissues owing to elevated temperature, which is not conducive for spermatogenesis. The hypoplastic testis showed reduced spermatogenic activity and slight testicular degeneration, similar to earlier reports in rams (Bousmaha & Khoudja, 2012) and bucks (Kafi *et al*., 2007) with testicular hypoplasia. Similar findings have also been reported in trypanosome-infected rams (Okubanjo *et al*., 2014) and in a bilateral cryptorchid camel (Adeyeye *et al*., 2020). The reduced spermatogenic activity could result from the small testis causing testicular degeneration, thereby leading to subfertility. The histological changes in the hypoplastic testis were less severe compared to the cryptorchid, similar to the findings of Uyar *et al*. (2019). This may be attributed to the location of the abnormalities. Cryptorchid testes are located in regions such as the abdomen, inguinal area or subcutis that hinder spermatogenesis leading to severe degenerative changes.

In conclusion, the study shows that testicular abnormalities are rare in rams slaughtered in the two slaughterhouses in Sokoto. Rams with testicular abnormalities may be unfit for breeding due to the histological changes in the testes.

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No funding was received.

Conflict of Interest

The authors declare that there is no conflict of interest.

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