PREVALENCE OF CRYPTORCHID TESTIS AMONG BULLS SLAUGHTERED AT THE JOS MAIN ABATTOIR

[1]MANGDEN, Tongpan Eliab, [1]KUZAYED, Imaben Grace, [2]TANKO, Polycarp Nwuniji and [1,3]ADEYEYE, Adewale Ayodeji

[1]Department of Theriogenology and Production, Faculty of Veterinary Medicine, University of Jos, Jos, Plateau State, Nigeria.

[2]Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Jos, Jos, Plateau State, Nigeria.

[3]Department of Theriogenology and Animal Production, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria.

Corresponding Author: Adeyeye, A. A. Department of Theriogenology and Production, Faculty of Veterinary Medicine, University of Jos, Jos, Plateau State, Nigeria. **Email:** adewale.adeyeye@udusok.edu.ng **Phone:** +234 803 285 9940

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ABSTRACT

Cryptorchidism is the failure of one or both testes to descend into the scrotum at the time specified for an animal species. The study was designed to determine the occurrence of cryptorchidism in bulls slaughtered at the Jos main abattoir. Out of 255 bulls examined, 3(1.18%) had cryptorchid testes. Unilateral cryptorchidism occurred more than bilateral and was majorly on the right. The condition was more prevalent in bulls 2≥ - <2½ years old than in other age groups, while subcutaneous testis was seen more than other abnormal types of cryptorchid testis. The longitudinal length, weight and mid-testicular circumference of the cryptorchid testes were significantly (p<0.05) smaller than the descended testes. The study showed a low prevalence of cryptorchid testis among bulls slaughtered at the Jos main abattoir. In addition, the cryptorchid bulls showed pathological lesions characterized by testicular degeneration suggesting the bulls may not be fit for reproduction. It is therefore recommended that further studies be carried out to determine the fertility and pathological differences among the various types of undescended cryptorchid testis.

Keywords: Cryptorchidism, Jos, Abattoir, Bulls, Testis

INTRODUCTION

The global cattle population is estimated to be about 940 million heads with over 370 million heads in Africa (Shahbandeh, 2023). Cattle are found throughout Nigeria but are most common in the northern two-thirds of the country (Blench, 1999). They are the most important livestock species in the country accounting for over 21.16 million heads of the total livestock population in Nigeria (Susa, 2023). They are the major source of milk, meat, hides and drought power (Felius *et al*., 2011). In addition, their horn, hide and skin are also beneficial, while their blood and bone are used in animal feed (Bourn, 2010). Cattle are also used for ploughing, harrowing, ridging and lifting of water from deep wells (Blench, 1999). However, cattle productivity depends on their reproductive performance (Alves *et al*., 2020) and reproductive conditions such as congenital abnormalities are a major hindrance to their productivity.

Cryptorchidism is a congenital abnormality that is the failure of one or both testes to be positioned in the scrotum at the time normal for

a species of animal and is usually detected at birth or shortly thereafter (Amann and Veeramachaneni, 2006). It can be unilateral or bilateral even though unilateral are most common (Igbokwe *et al*., 2009). The cryptorchid testicle may be located at any point along the normal path of descent (abdominal or inguinal cavity or subcutis) or it may be diverted to an ectopic location (Leslie *et al*., 2023). Emerging evidence suggests that cryptorchidism is more multifactorial than a single disease entity since it provides early evidence of other phenotypic defects such as tumours and defects in spermatogenesis (Amann and Veeramachaneni, 2007).

In Nigeria, there is paucity of information on the occurrences of cryptorchidism in bulls. Apart from the report of Adeyeye and Wakkala (2013) in Sokoto and Kumi-Diaka *et al*. (1989) in selected parts of northern Nigeria, no other report exists in Jos or other parts of Nigeria to the best of our knowledge. However, cryptorchidism has been reported in buck (Igbokwe *et al*., 2009), camel (Adeyeye *et al*., 2020) and ram (Adeyeye *et al*., 2022), where lesions suggestive of infertility have been observed. This study is therefore aimed at determining the occurrence of cryptorchid testis among bulls slaughtered at the Jos main abattoir.

MATERIALS AND METHODS

Study Area: The study was carried out at the Jos main abattoir (GPS 9.887254, 8.887351), Jos, Plateau State, Nigeria. The Jos main abattoir is located in Jos, the capital of Plateau State in the middle belt region of Nigeria. Plateau State, lies between Latitude 89° 30′ N and Longitude 8° 20′ E (Olowolafe, 2008). In addition, Jos City lies in an altitude ranging from 1,200 meters to 1,829 meters above sea level with a total land mass of 26,899 km^2 and an annual temperature of between 18 and 22^0C (Olowolafe, 2008).

Study Design: It was a prospective abattoir-based study involving bulls presented for slaughter. At the abattoir, the owner's consent was obtained before the examination of the bulls. The breed of the bulls was determined using morphological features as described by Wosu (2002). In addition, their ages were determined using their dentition. Their testes were examined immediately after slaughter before flaying by scrotal palpation. No further examination was conducted on bulls with bilaterally descended testes. However, those with evidence of undescended testes were examined further after flaying and the location of the undescended testes was noted. The testes and their corresponding descended testes (in cases of unilateral cryptorchidism) were collected by cutting off the spermatic card and transported to the Theriogenology Laboratory, Faculty of Veterinary Medicine, University of Jos. At the Laboratory, their weights were determined using an electronic scale (Kerro Electronic Compact Scale, BL 5002 Model, Taiwan) calibrated in grams. Furthermore, their testicular height and mid-circumference were determined using a measuring tape in centimetre. Cut sections from both descended and undescended testes were collected and fixed in 10% buffered formalin for 48 hours and processed for histological examination as described by Bancroft and Gamble (2008). Briefly**,** the samples were dehydrated in ascending grades of alcohol at 70, 80, 90% and absolute alcohol in plastic cassettes, cleared in xylene, infiltrated with liquid paraffin and embedded in paraffin wax using an automated tissue processor. The tissues were embedded in the melted paraffin using a tissue embedder and the blocks were trimmed and sectioned to approximately 5 µm thick in size with microtome. The tissue ribbon sections were placed on the clean glass slides and rehydrated in descending grades of absolute alcohol, 90, 80 and 70% alcohol for two minutes and then rinsed with tap running water. Finally, stained with Haematoxylin and Eosin and examined under a light microscope. Photomicrographs from the stained sections were photographed with a Motic microscope digital camera (Hong Kong, China).

Data Analysis: Data generated were analyzed using descriptive statistics; also data were subjected to analysis of variance (ANOVA).

Independent sample t-test was used to compare the cryptorchid and descended testes in terms of longitudinal length, mid-testicular circumference, and weight. Significant differences between means were set at $p<0.05$. All data were analysed using GraphPad InStat Version 2000.

RESULTS

The overall prevalence of cryptorchidism in bulls slaughtered at the Jos main abattoir indicated that out of 255 bulls examined, three were cryptorchid representing a prevalence of 1.18% (Table 1).

Table 1: Overall prevalence of cryptorchid testis in bulls slaughtered at the Jos main abattoir

Number Examined	Number Cryptorchid	Prevalence (%)
255	3	1.18%

The distribution of cryptorchid testis based on type, breed, age and location, showed that all the cryptorchid testes were unilateral and these occurred in the Bunaji breed of cattle (Table 2).

Table 2: Distribution of cryptorchid testes according to type, breed, age and location in bulls examined at the Jos main abattoir

Type of Cryptorchid	Number Cryptorchid	Prevalence (%)
Unilateral	3	100.00
Bilateral	0	0.00
Breed		
Bunaji	3	100.00
Others	0	0.00
Position of Unilateral Cryptorchid		
Right	2	66.67
Left	1	33.33
Age of Cryptorchid Bull (Years)		
<2	0	0.00
2≥ - <2½	3	100.00
2½≥ - <3	0	0.00
3≥ - <3½	0	0.00
Location of Cryptorchid Testis		
Subcutaneous	2	66.67
Inguinal	1	33.33
Abdominal	0	0.00

Two (66.67%) of the unilateral cryptorchid testes were on the right, while 1(33.33%) was on the left. The age of the cryptorchid bulls fell within the age group 2≥ to <2½ old. Based on location, 2(66.67%) were subcutaneous, while 1(33.33%) was inguinal.

Testicular morphometry of the descended and cryptorchid testes indicated that the longitudinal length of the cryptorchid testes (7.83 ± 1.32 cm) was significantly shorter ($p<0.05$) than the descended testes (11.70 ± 0.44 cm) (Table 3).

Table 3: Testicular morphometry of descended and cryptorchid testes of bulls examined at the Jos main abattoir

Testicular Parameters	Descended testes	Cryptorchid testes
Longitudinal Length (cm)	11.70 ± 0.44*	7.83 ± 1.32
Weight (g)	103.24 ± 18.98*	34.24 ± 15.53
Mid-testicular circumference (cm)	14.97 ± 1.62*	8.10 ± 2.72

**Statistically significant means at p<0.05 using t-test pairwise comparison*

The weight of the cryptorchid testes (34.24 ± 15.53 g) was also significantly lesser ($p<0.05$) than the descended testes (103.24 ± 18.98 g). In addition, the mid-testicular circumference of the cryptorchid testes (8.10 ± 2.72 cm) was also significantly lesser ($p<0.05$) than the descended testes (14.97 ± 1.62 cm).

Grossly, the cryptorchid testes were smaller than the descended testes (Figure 1).

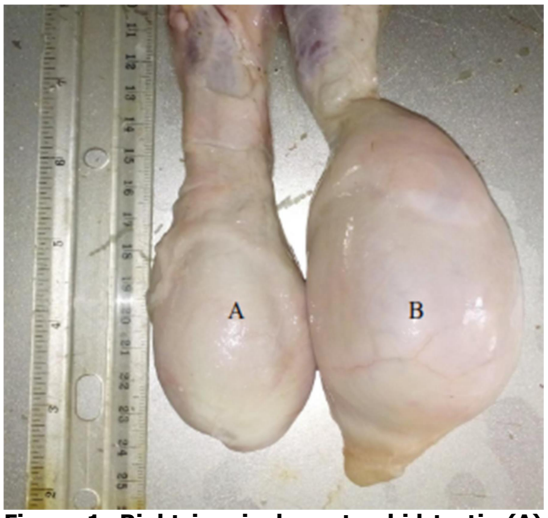

Figure 1: Right inguinal cryptorchid testis (A) and left descended testis (B) of a Bunaji bull at slaughter at the Jos main abattoir

The seminiferous tubules of the descended testis showed evidence of spermatogenesis in the tubular lumen (Figure 2a), while that of the cryptorchid testis showed degenerated seminiferous tubules and disrupted cellular architecture (Figure 2b). The epididymis of the descended testis showed the lumen with sperm reserve (Figure 3a), but the lumen of the epididymis in the cryptorchid testis was devoid of sperm reserve (Figure 3b).

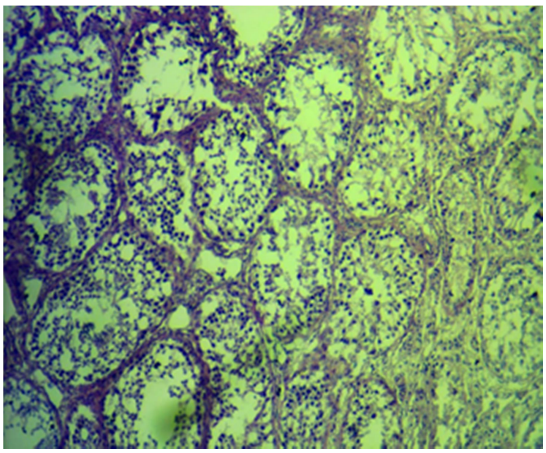

Figure 2a: Photomicrograph of the seminiferous tubules of descended testis showing evidence of spermatogenesis in the tubular lumen (H&E x 10)

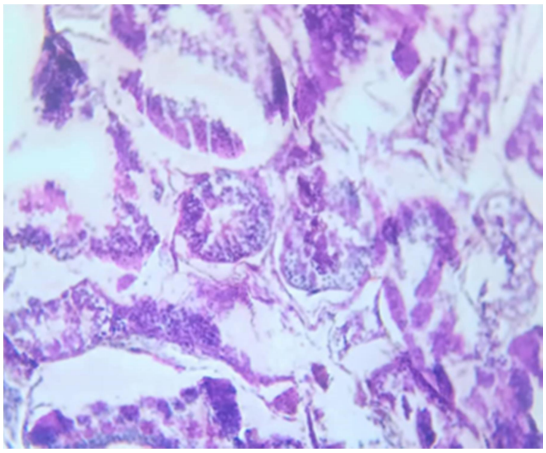

Figure 2b: Photomicrograph of the seminiferous tubules of cryptorchid testis showing degenerated seminiferous tubules and disrupted cellular architecture (H&E x 10)

DISCUSSION

The prevalence of cryptorchid testis observed in this study for bulls in Jos, Nigeria was similar to the 1.74% reported by Adeyeye and Wakkala (2013) in Sokoto, Nigeria. It is also within the 1.0 – 1.7% range reported from North America (Jean *et al.,* 1992), Ethiopia (Gemeda, 2017), Rwanda (Kandiwa *et al.,* 2017) and Cameroon (Kouamo and Nyonga, 2022). The prevalence in the present study was lower than the 3.18% reported among bulls in Central Ethiopia by Migbaru *et al.* (2014), but higher than the 0.05 – 0.63% reported among bulls in Port Harcourt, Nigeria (Wekhe and Yahaya, 1999) and Canada (Barth and Waldner, 2002).

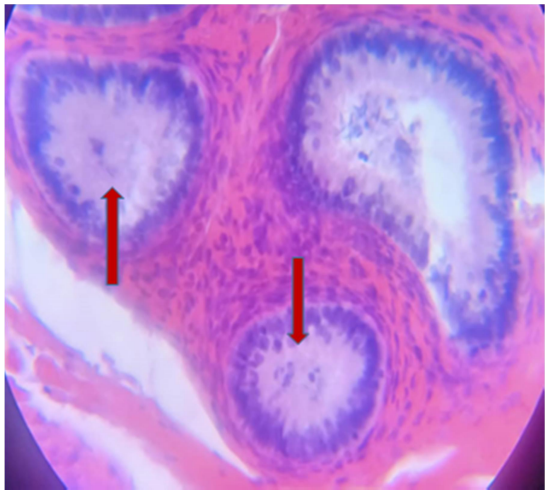

Figure 3a: Photomicrograph of the epididymis of the descended bull showing the lumen with sperm reserve (H&E x 100)

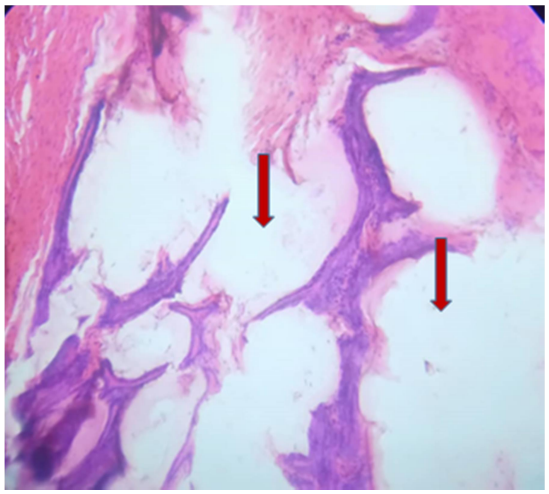

Figure 3b: Photomicrograph of the epididymis of the cryptorchid bull showing the lumen devoid of sperm reserve (H&E x 100)

The finding was also higher than the 0.25 - 0.6% reported in bucks (Wekhe and Yahaya, 1999; Igbokwe *et al.*, 2009), 0.58% in camels

(Adeyeye *et al*., 2020) and 0.31% in rams (Adeyeye *et al*., 2022). The occurrence of cryptorchidism was thought to be generally as low as 0.5% among mammals (Amann and Veeramachaneni, 2007) such as bulls. The higher prevalence in the current study may be attributed to the consumption of estrogenic substances that predispose them to cryptorchidism. The majority of the cattle slaughtered at the Jos main abattoir are raised in the semi-arid region of Nigeria that is characterized by scarcity of feed due to drought leading to grazing on every type of pasture such as plants rich in estrogen.

All the cryptorchid testes in this study were unilateral. A similar trend has been reported in goats (Igbokwe *et al*., 2009) and rams (Adeyeye *et al*., 2022), although there are more reports of bilateral cryptorchidism than unilateral in the camel (Vyas *et al*., 1996; Adeyeye *et al*., 2020). Cryptorchidism may either be unilateral or bilateral (Bearden *et al.,* 2004) although, unilateral cryptorchidism are more common than bilateral (Marcus *et al.,* 1997). In the current study, the unilateral cryptorchidism was more on the right testis than the left. This was different from previous reports in bulls (Adeyeye and Wakkala, 2013), but similar to the report of Adeyeye *et al*. (2022) in rams. The mechanism responsible for laterality in the occurrence of cryptorchidism is not well known. However, earlier studies suggest that the left testis was more prone to morphological abnormalities than the right (Oyeyemi and Babalola, 2006). All the bulls with cryptorchid testis in the present study were 2 to 2½ years old, in contrast to the findings of Adeyeye and Wakkala (2013) where majority of the cryptorchid bulls presented for slaughter at the Sokoto abattoir were less than one year old. It is possible the cryptorchid testes in the present study were discovered early in life but the bulls were culled and fattened until they were sold and brought to Jos for slaughter.

The current study revealed that the subcutis was the most common location for the cryptorchid testis in the bull similar to the report of Adeyeye and Wakkala (2013). It is also similar to the findings in camel (Adeyeye *et al*., 2020) and rams (Adeyeye *et al*., 2022). The sub-cutis is the last major location before the final descent into the scrotum. Maternal and environmental factors have been implicated in disrupting testicular descent by altering the release of androgens required for testicular descent into the scrotum (Leslie *et al*., 2023). The longitudinal length, testicular weight, and mid-testicular circumference of the cryptorchid testes were substantially smaller than the normal testes. This was consistent with previous reports in the bull (Adeyeye and Wakkala, 2013), buck (Kafi *et al.,* 2007; Igbokwe *et al*., 2014) and ram (Adeyeye *et al*., 2022). However, the latter reported an insignificant longitudinal length of the cryptorchid testis of the ram, in contrast with Adeyeye *et al*. (2020) who found no differences in all the morphometry of a cryptorchid camel. A change in the morphometric parameters of cryptorchid testis characterized by a decrease in size is a common finding and this is believed to be caused by alterations during embryonic development due to elevated body temperatures (Amann and Veeramachaneni, 2007). There was degeneration of the seminiferous tubules with disrupted architecture. The activities of seminiferous tubules are known to be sensitive to temperature (Cai *et al*., 2021). Testicular degeneration occurs due to elevated temperature and often progresses to atrophy of the seminiferous tubules leading to disrupted architecture. The lumen of the epididymides was devoid of sperm reserve similar to the reports of Igbokwe *et al*. (2011) in the buck and Adeyeye *et al*. (2022) in the ram with cryptorchid testis. The arrest of spermatogenesis due to a temperature rise may have caused the void sperm reserve.

Conclusion: In conclusion, the study shows that cryptorchidism exists among bulls presented for slaughter at the Jos main abattoir, although with a low prevalence. Additionally, the cryptorchid bulls showed pathological lesions characterized by testicular degeneration suggesting the bulls may not be fit for reproduction. Due to the paucity of information on the occurrence of cryptorchidism in bulls in Nigeria, it is therefore recommended that more

studies be done to determine the occurrence of this congenital abnormality affecting the fertility of the bull and other animals. In addition, further studies are required to determine the fertility and pathological differences among the various types of undescended testis.

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