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# Gross Reproductive Organs Abnormalities in Bulls of Northern Regions of Cameroon

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## Abstract

A cross-sectional study using systematic random sampling was conducted on ante mortem and postmortem examination of 602 intact bulls slaughtered at the Ngaoundere (201), Garoua (200) and Maroua (201) municipal abattoirs from April 2021 to September 2021 to determine prevalence and associated risk factors of gross reproductive pathologies observed in the reproductive tract. After slaughter and evisceration, the entire genital tract of each male was thoroughly inspected for gross pathological abnormalities. Visual inspection, palpation, serial and systematic dissections into the parenchyma of the testes and scrotum were performed to determine the presence and the extent of gross pathological changes via post mortem examination. The overall mean age (year), weight (kg) and BCS (body condition score) of bulls were 6.8±2.63, 173.80±16.08 and 2.4±0.3, respectively. Out of the 602 intact bulls examined, 165 (27.4%) were affected by one or more gross genital abnormalities. The genital part with the greatest rate of occurrence of reproductive disorder was testes (19.3%), followed by the penis (11.8%), the scrotum (1.5%) and the ducts (0.2%). Ngaoundere, Garoua and Maroua municipal slaughterhouses had prevalences of 26.9%, 35%, 14.4% respectively. Scrotal ectoparasitism was the most common disorder with an overall prevalence rate of 3.8% (n=23/602) followed by balanoposthitis (3,3%; n=20/602), unilateral testicular hypoplasia (3.0%; n=18/602), bilateral hypoplasia (2.8%; n=17/602), unilateral atrophy (2,7%; n=16/602), testicular degeneration (2,5%; n=16/602), balanitis (2.5%; n=14/602). At the Ngaoundere, Garoua and Maroua municipal abattoirs, scrotal ectoparasitism (ticks) (9%; n=18/201), balanoposthitis (5.5%; n=11/200) and bilateral hypoplasia, unilateral and bilateral atrophy (2.5%; n=5/201), were the most common disorder, respectively. Weight and BCS did not vary significantly with genital-tract abnormalities (P>0.05).

**Keywords:** Bulls, Testes, Penis, Scrotum, Abnormalities

## Introduction

Most of the third world countries located at the tropics, productions of livestock resources are very important to their countries (1). Cattle production is the main component of livestock production in sub-Saharan countries (2). Livestock play a major role in the socio-economy of the central Africa semi -arid region.

Cattle farming in Cameroon provides 110000 tonnes of meat annually; its contribution represents 54% of all meat products produced locally and consumed by the population (3). There is a need to increase the supply of animal protein through meat consumption and this could be accomplished through efficient use of promising indigenous animals such as beef (4). The recommended total minimum protein intake for an adult is 85.9 grams daily of which 34 grams (40 %) should be of animal origin. Animal products supply about 17 % of the energy and 32 % of the protein eaten by people (5). In Cameroon 83% of cattle breeding is located mainly in the northern regions (Adamawa, North and Extreme North). The remaining (17%) is repartition in the Southwest, Northwest and Eastern regions. Cattle breeding is the source of animal proteins of the populations (6).

The predominant breeding management system in Cameroon is natural mating. Regardless of the effects of the bull reproductive tracts abnormalities on the fertility and productivity of cattle production; especially in cattle production system which applies natural mating as animal reproductive management system (7) such as in Cameroon, there is paucity of information on genital tract abnormalities of the bulls in Cameroon since very few studies have been conducted on sub-fertility or infertility due to testicular abnormalities of the bulls. In contrast, particular about the scope and prevalence of the different types of genital tract abnormalities of bulls will help for proper diagnosis and treatment of diseases and to implement suitable prevention and control approaches thus, to maximize fertility and productivity of cattle production. However, the animal productivity is found to be lower than it should be due to a number of constraints such as poor genetic potential, malnutrition, high disease incidence, thermal stress and poor management conditions (8). Reproductive performance is one of the major determinants of cattle productivity in any production systems. The contribution of the bull either through natural mating or artificial insemination (AI) is the determinant factor, because each bull represents half of the genetic composition of its progeny and many cows can be inseminated with the semen of a single bull (9). Failure of many bulls to breed consistently and efficiently has been reported to be associated with the production of poor quality semen due to the pathology of testes and accessory glands. Gross testicular pathologies classified as congenital causes like hypoplasia and cryptorchidism and acquired causes like testicular degeneration, orchitis, calcification, testicular hematoma and epididymitis. All of the abnormalities have a negative effect on productivity and fertility of the bull (10). Thus, the fertility or reproductive capacity of the individual bull determines the reproductive performance of a herd (11) and is essential for sustainable cattle production (12). The fertility of farm animals depends on the reproductive performance of the animals but reproductive diseases cause undesirable serious consequences in the productivity of livestock.

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Fertility in bulls receives inadequate attention (11) and it is assumed that infertility is a female problem (13). Moreover, scientific and practical or management aspects of cattle production usually focused on the cows (14). As a result, several aspects of male livestock reproduction are comparatively ignored (7). Particularly, in bulls used for natural breeding fertility is rarely investigated as compared to bulls used for artificial insemination. These can lead to substantial and expensive delay in the detection of fertility problems in the cattle herd reared under natural breeding system (11).

Sub-fertility, infertility and sterility occur in bulls due to diverse causes (11), among which congenital or acquired reproductive tract abnormalities are the main (15). Different visible or palpable physical abnormalities of the testes, scrotum or epididymis may cause infertility in bulls and undermine productivity of the livestock (10). Much has been done on female genital abnormality but very little has been done on males, reason for the present study. Few studies were carried out on the prevalence and risk factors of genital tract abnormalities on bulls slaughtered in Africa and elsewhere(16) and similar studies have not taken place in northern regions of Cameroon (Adamawa, North and Far North). It is in this context that this research was conducted. The main aim of this work is determining the different prevalence of gross reproductive tract abnormalities in bulls slaughtered. Specifically, we will have to characterize the animals available for this study, to identify the different types of reproductive disorders of the bull and to evaluate the influence of risk factors on the occurrence of the reproductive disorders.

## Materials and Methods

### *Ethical statement*

The study was approved by the Ethical committee of the School of Veterinary Medicine and Sciences of the University of Ngaoundere as well as the ministry of livestock, fisheries and animal industries.

### *Study area*

Northern Cameroon is a geopolitical region in Cameroon administratively divided into three regions: the Far North Region (10° - 12° N, 14° - 15° E), the North Region (8° – 10° N, 12° - 14° E) and the Adamawa Region (5° - 8° N, 11° - 14° E). This work was carried out in Ngaoundere, Garoua and Maroua which are they biggest towns in the Adamawa, North and Far North Regions of the Cameroon, respectively. The various municipal slaughterhouses were chosen because there are the main slaughter sites for cattle consumed in the city of Ngaoundere, Garoua, Maroua and its surroundings.

### *Animals*

Majority of animals slaughtered at the abattoirs were purchased at the cattle markets which majority of animals originated from the Vina and Gazawa localities. In Ngaoundere a gross majority of animals slaughtered at the abattoir were purchased on site at the ¨Ngaoundere II¨ market from traders who obtained these animals from diverse peri-urban markets in localities like Mbe, Meiganga, Tibati, Ngaoundal and on rear occasions from the Northern regions. In Garoua majority of animals slaughtered at the abattoir were purchased from the Pitoa and Adoumri market which was the largest cattle market in Central Africa and on rear occasions from the Extreme North region and Chad while in Maroua a gross majority of animals slaughtered at the abattoir were purchased on site at the Gazawa market which was the largest market in the Extreme North region from traders who obtained these animals from diverse peri-urban markets such as Bogo. The sample size was determined using formula of Thrusfield (17). The expected prevalence under such a context is estimated at 50% using 95% confidence interval, 5% desired absolute precision due to lack of epidemiological data. Bulls were randomly selected on each abattoir visit. The age calculated as described by Pace & Wakeman (18). Body Condition Score (BCS) estimated as described by Nicholson & Butterworth (19). The cattle breeds were phenotypically characterised. The weight was estimated using as proposed by Njoya et al. (20).

### *Genital abnormalities diagnosis*

After slaughter, the whole genitalia consisting of the penis, prepuce, testes, epididymis, and scrotal sac were examined for evidence of gross pathological abnormalities. Testicular conditions such as bilateral testicular hypoplasia and atrophy were identified through gross changes in size, texture, and consistency of the testes. The spermatic cord was palpated up to the level of the inguinal ring for the presence of abdominal contents (scrotal hernia) or abnormalities of spermatic vasculature. After palpation of the preputial part of the penis, exteriorisation of its free part where possible, palpation of the sigmoid flexures and palpation of the prepuce and preputial orifice.

### *Data analysis*

Data generated from ante-mortem and post-mortem inspection were recorded in the Microsoft Excel 2013, risk factors analysed with Chi square and those significant ($P<0.05$). Risks factors which significance were further analyzed using logistic regression model analysis to assess associations between incidences of the gross genital disorders and analyzed using SPSS version 23.0. Finally, a multivariate analysis was conducted to see whether, and to what extend all the risk factors and each genital tract abnormality were interrelated.

## Results

### *Characteristic of slaughtered animals*

A total of 602 of bulls were examined prior to slaughter at the various municipal abattoirs with 201, 200 and 201 from Ngaoundere, Garoua and Maroua municipal abattoirs, respectively. The four main breeds encountered in this study were White Fulani (35.4% n=213), Red fulani (28.4% n=171), Gudali (24.4%, n=147) and Bokolo (11.8%, n=71).

The Frequency distribution of breeds in the different abattoirs were Gudali (62.5%, n=126), White Fulani (19%, n=38), Bokolo (9.5%, n=19), Red Fulani (9%, n=18) in NMA (Ngaoundere municipal abattoir) ; White Fulani (60.7% n=122), Red Fulani (20.9% n=42), Bokolo (12.9% n=26), Gudali (5.5%, n=10) in Garoua municipal abattoir (GMA); Red Fulani (55.2%, n=111), White Fulani (26.9% n=54), Bokolo (12.9% n=26), Gudali (5.0% n=10) in Maroua municipal abattoir (MMA). In general, 42.4% (n=255) of bulls originated from the Far North, 36.4% (n=219) from Adamawa, 20.4% (n=123) from the North and 0.8% (n=5) from Chad. The mean body condition score (BCS) of the animals was 2.4±0.3 with a range of 1 to 3. A good number of bulls had a BCS of 2. The global average body weight of the animal sampled was 173.80 ± 16.08 kg with minimum being 75 kg and maximum 280 kg. The global average age of the animals was 6.8±2.63 years old.

### *Types of genital tract abnormalities encountered at the municipal Abattoirs*

Overall, 165 (27.4%) out of the 602 examined bulls were affected by one or more gross genital abnormalities of unidentified causes. The genital part with the greatest rate of occurrence of reproductive disorder was testes (19.3%),

followed by the penis (11.8%), the scrotum (1.5%) and the ducts (0.2%) (Table 1). Scrotal ectoparasitism was the most common disorder with an overall prevalence rate of 3.8% (n=23/602) followed by balanoposthitis (33%; n=20/602). The least prevalent among the gross disorders were penile laceration (0.5%; n=3/602), oochitis (0.5%; n=3/602), epididymitis (0.2%; n=1/602) (Table 1).

At the Ngaoundere municipal abattoir, 54 (26.9%) of the 201 examined bulls were affected by one or more gross genital tract abnormalities of unidentified causes. Scrotal ectoparasitism (thicks) was the most common disorder with an overall prevalence rate of 9% (n=18/201) followed by testicular degeneration (5,5%; n=11/201), unilateral hypoplasia (4%; n=8/201), balanitis (4%; n=8/201), balanoposthitis (3.5%; n=7/201), scrotal cellulitis (2,5%; n=5/201), crytochidism (2.5%; n=5/201), penile hematoma (2%; n=4/201), bilateral hypoplasia (1,5%; n=3/201), unilateral atrophy (1,5%; n=3/201), phimosis (1,5%; n=3/201), hydrocele (1,0%; n=2/201), hematocele (1%; n=2/201), paraphimosis (1%; n=2/201), oochitis (1%; n=2/201). The least prevalent among the gross disorders were testicular hematoma (0.5%; n=1/201), epididymitis (0.5%; n=1/201), preputial agenesis (0.5%; n=2/201).

At Garoua municipal abattoir, 70 (35%) of the 200 examined bulls were affected by one or more gross genital tract abnormalities of unidentified causes. Balanoposthitis was the most common disorder with an overall prevalence rate of % 5.5 (n=11/200) followed by bilateral hypolasia (4,5%; n=9/200), unilateral atrophy (4%; n=8/202), unilateral hypoplasia (3.5%; n=7/200), balanitis (3%; n=6/200), preputial agenesis (2%; n=4/200), paraphimosis (2%; n=4/200), testicular degeneration (2%; n=4/200), crytochidism (1.5%; n=3/200), phimosis (1.5%; n=3/200), penile hematoma (1.5%; n=3/200), testicular hematoma (1.5%; n=3/200), penile laceration (1.5%; n=3/200), white buttons (1.5%; n=3/200), posthitis (1%; n=2/200), hydrocele (1%; n=2/200), scrotal ectoparasitism (1%; n=2/200). The least prevalent among the gross disorders were oochitis (0.5%; n=1/200), bilateral atrophy (0.5%; n=1/200).

At Maroua municipal abattoir, 29 (14.4%) of the 201 examined bulls were affected by one or more gross genital tract abnormalities of unidentified causes. Bilateral hypoplasia, unilateral atrophy, bilateral atrophy were the most common disorder with an overall prevalence rate of 2.5% (n=5/201) followed by scrotal ectoparasitism (1,5%; n=3/201), posthitis (1.5%; n=3/201), unilateral hypoplasia (1.5%; n=3/201), preputial agenesis (1%; n=2/201), white buttons (1%; n=2/201), balanoposthitis (1%; n=2/201). The least prevalent among the gross disorders were paraphimosis (0.5%; n=1/201), testicular degeneration (0.5%; n=1/201).

Bulls of 4-7 age group were seen to have a significant high prevalences (P<0.05) than the other age groups (Table 3). Age was observed to vary greatly with Balanitis, Paraphimosis and Penile hematoma. The bulls of 4-7years of age were 0.195 times more likely to be affected with Balanitis and 0.066 times more likely to get infected with paraphimosis. Bulls of the old age group (≥8years) were 0.016 times more likely to be with Penile Hematoma thang young aged bulls (Table 2).

The prevalence of unilateral hypoplasia and scrotal ectoparasitism significantly varied with breed (P<0.05).The specific incidence of breed in all pathological conditions gotten in this present study for Bokolo, Gudali , Red Fulani, White Fulani were 3.6%,32.0%,21.0% and 28.2% respectively. Gudali was seen to have a significant high prevalence (P<0.05) compared to other breeds (table 3). The odds of breeds and unilateral hypoplasia revealed Gudali and Red Fulani were 4.335 and 1.243 times more likely at risk respectively compared to the White Fulani breed (table 2). Breed also varied significantly with scrotal ectoparasitism. The Bokolo breed was 5.40 times more likely to be affected with scrotal ectoparasitism (table 2). Slaughterhouses did not cause any significant discrepancy in the prevalence of gross genital-tract abnormalities except in the case of Ngaoundere which varied greatly (P<0.05).

Table 1: Odd Ratio (OR) for the different significant risk factors of reproductive abnormalities in bulls destined for slaughter at the abattoirs combined

| Factors | Variables | Pathologies | N | N* | Pr | OR | P- value($X^2$ |
|---|---|---|---|---|---|---|---|
| **Age (Year)** | Adult 4-7 | Balanitis | 312 | 4 | 0.7 | 0.195 | 0.006(2.870) |
| | | Paraphimosis | 312 | 1 | 0.2 | 0.066 | 0.026(7.665) |
| | Old( ≥8) | Penile hematoma | 218 | 1 | 0.2 | 0.016 | 0.000(52.134) |
| **Breed** | Gudali | Unilateral testicular Hypoplasia | 147 | 9 | 1.5 | 4.335 | 0.026(7.714) |
| | Bokolo | Scrotal ectoparasitism | 71 | 5 | 0.8 | 5.40 | 0.042(11.765) |
| **Origin** | Adoumri | Unilateral testicular Hypoplasia | 9 | 1 | 0.2 | 70.088 | 0.001(42.813) |
| | | Bilateral testicular Hypoplasia | 24 | 2 | 0.3 | 23.831 | 0.006(48.083) |
| | Chad | Bilateral testicular Hypoplasia | 5 | 1 | 0.2 | 503.693 | 0.005(48.083) |
| | Djamboutou | Balanoposthitis | 2 | 4 | 0.7 | 0.038 | 0.038(45.244) |
| | Meiganga | | 8 | 2 | 0.3 | 0.041 | 0.006(45.244) |
| | Mokolo | | 2 | 1 | 0.2 | 0.019 | 0.021(45.244) |
| | Tibati | Balanitis | 12 | 2 | 0.3 | 37.619 | 0.000(49.377) |
| | Tignere | | 8 | 1 | 0.2 | 16.090 | 0.017(49.377) |
| | Djamboutou | Penile hematoma | 42 | 0 | 0 | 40.469 | 0.038(108.552) |
| | Maroua | | 121 | 1 | 0.2 | 25.238 | 0.003(108.552) |
| | Ngaoundere | | 24 | 2 | 0.3 | 1003.960 | 0.000(108.552) |
| | Ngong | | 41 | 1 | 0.2 | 67.432 | 0.001(108.552) |
| | Pitoa | | 54 | 4 | 0.7 | 47.432 | 0.002(108.552) |
| | Touborro | | 9 | 1 | 0.2 | 46.610 | 0.001(108.552) |
| **Slaughterhouse** | NMA | Penile hematoma | 201 | 54 | 26.9 | 41.710 | 0.003(3.759) |

N=number of animals examined, N*=number affected, Pr. = Prevalence, OR= odd ratio.

Table 2: Overall prevalence of genital diseases of bulls based on age, BCS, origin, weight, breed and slaughterhouses

| Characteristics | | N | N* | Prevalence % | P value |
|---|---|---|---|---|---|
| Age (years) | Young (1-3) | 72 | 35 | 5.8 | |
| | Adult (4-7) | 312 | 73 | 12.0 | 0.000 |
| | Old (≥ 8) | 218 | 57 | 9.4 | |
| BCS | Poor | 3 | 2 | 0.33 | |
| | Average | 403 | 101 | 16.8 | 0.074 |
| | Normal | 196 | 62 | 10.3 | |
| Weight (kg) | <200 (1) | 541 | 144 | 23.9 | 0.195 |
| | >200 (2) | 61 | 21 | 3.5 | |
| Breed | Bokolo | 71 | 22 | 3.6 | |
| | Gudali | 147 | 47 | 32.0 | 0.137 |
| | Red Fulani | 171 | 36 | 21.0 | |
| | White Fulani | 213 | 60 | 28.2 | |
| Slaughterhouses | Ngaoundere | 201 | 62 | 30.8 | |
| | Garoua | 200 | 73 | 12.1 | 0.000 |
| | Maroua | 201 | 30 | 5.0 | |
| Origin | Adoumri | 9 | 2 | 0.3 | 0.001 |
| | Banyo | 1 | 0 | 0 | |
| | Bogo | 63 | 6 | 9.5 | |
| | Chad | 5 | 4 | 0.7 | |
| | Djamboutou | 42 | 9 | 1.5 | |
| | Garoua | 6 | 1 | 0.2 | |
| | Gazawa | 69 | 10 | 1.7 | |
| | Guider | 1 | 2 | 0.3 | |
| | Maroua | 121 | 44 | 7.3 | |
| | Mayo-rey | 1 | 0 | 0 | |
| | Mbe | 2 | 2 | 0.3 | |
| | Meiganga | 8 | 6 | 0.9 | |
| | Mokolo | 2 | 2 | 0.3 | |
| | Ngaoundere | 24 | 10 | 1.7 | |
| | Ngong | 41 | 17 | 2.8 | |
| | Ngaoundal | 8 | 2 | 0.3 | |
| | Pitoa | 54 | 11 | 1.8 | |
| | Poli | 1 | 2 | 0.3 | |
| | Tibati | 12 | 5 | 0.8 | |
| | Tignere | 8 | 3 | 0.5 | |
| | Touborro | 9 | 7 | 1.2 | |
| | Vina | 115 | 30 | 5.0 | |

N=number of animals examined; N*=number affected

The specific incidences of slaughterhouses of all pathological conditions observed were 30.8%, 12.1% and 5.0% for Ngaoundere, Garoua and Maroua slaughterhouses respectively. Ngaoundere slaughterhouse was observed to have a high prevalence (P<0.05) compared to others (table 3). Bulls of the Ngaoundere slaughterhouse was 41.710 times more likely to have an abnormality compared to the Garoua slaughterhouse (table 2). Weight and BCS did not vary significantly with genital tract abnormalities (P>0.05) (table 3).

***Global correlations***

It can be seen from figure 1 that: (a) there is a strong correlation of 0.8 between origin and slaughterhouses; (b) there is association between hematocele and ectoparasite, and (c) balanitis is correlated to both age and breed.

## Discussion

In this study, out of 602 locale breed bulls examined 27.4% were affected by one or more gross reproductive tract abnormalities of unidentified causes. This incidence level of gross testicular abnormalities of bulls was lower than those obtained by Kouamo & Eta (16) in the littoral region (Cameroon), Eshetu et al. (21) and Migbaru et al. (22) in central Ethiopia who respectively reported 75.5, 52.5 and 30.4% but higher than those obtained by Barth & Waldner (23) in beef bulls in Canada and Silva et al. (24) in Brahman, where the prevalence 22.1 and 8.37, respectively. The difference may be due to diverse influences like breed, sample size, environmental and nutritional factors. A high number of genital lesions is probably due to many factors that include: poor housing, inadequate knowledge of the owner's, bad managements, number of animals sampled which varied from one study to another, insufficient nutritional level and increased contamination (25). It had been documented that sex-related disorders in domestic animals varied depending upon the species and breed and the selection practice used by breeders (26).

Scrotal ectoparasitism was the most frequently abnormalities represented with prevalence rate of 3.8% (n=23/602). This is in contrast with fact that testicular hypoplasia is reported to be the most common reproductive abnormality of bull encountered by veterinary practitioners (13). Significantly varied differences in the prevalence of scrotal ectoparasitsm ($\chi 2=21.78$; P<0.05) among breed, age, slaughterhouses and origins were observed. This study revealed

that Gudali bulls were more likely to be affected with scrotal ectoparasitsm than the other breeds, followed by Bokolo and Red Fulani, adult bulls were more likely to be affected with scrotal ectoparasitism than the younger and old animals, bulls brought to the NMA were more exposed with scrotal ectoparasitm compared MMA and GMA. Weight and body condition of bulls did not significantly affect the occurrences of scrotal ectoparasitsm (P>0.05). The prevalence of scrotal ectoparasitsm 3.8% in this study is lower than 4.3% in Canada, 5.3% and 4.7% both in Ethiopia, as reported by Kastelic (12), Eshetu et al. (21) and Migbaru et al. (22) respectively. But higher than 1.8% in Cameroon (16). These differences could be due to variations in the climatic condition of the study areas, study period, parasites infestation and breed of animals studied.

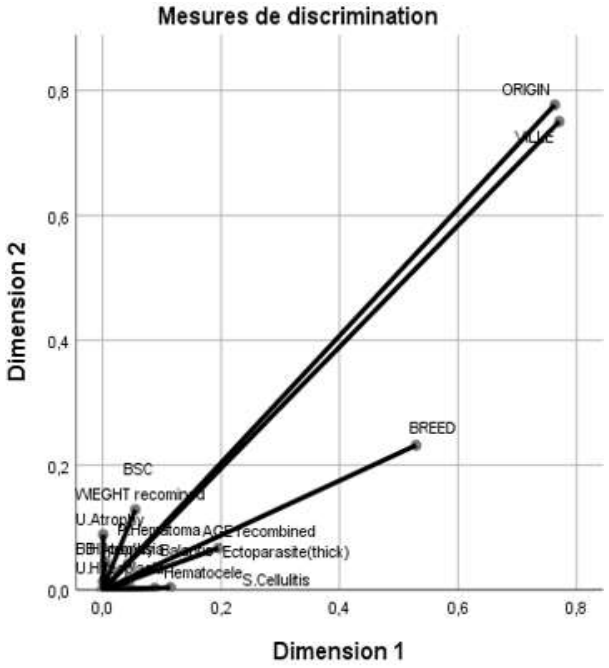

Figure 1: Global correlation between all variables

The prevalence of 3.3% of balanoposthitis in the present study is higher than 0.66% in Algeria (27) and 3.21% in brown Swiss breeds (24), 1.4% in Santa Gertrudis bulls, 3.1% in Brahman bulls (28); lower than the 30% obtained in the littoral Cameroon (16) ,18.8% in Eastern Ethiopia (21) and 14.4% in Addis Ababa (22) and 3.45% in Brahman (24). This result was 3 times superior to that recorded in feral male goats by Tarigan et al. (29) in Australia (1.1%). There was a significant difference between slaughterhouses and balanoposthitis, bulls brought to the GMA were more exposed with balanoposthitis followed by NMA and MMA. This unusual high prevalence could be due to the fact that there is inadequate examination and attention given to bulls in herds and untimely detection of reproductive problems hence, leading to infection, maybe also due their geographical origin and environment (season).

Testicular hypoplasia in this study (5.8%) was higher than 0.66% in Algeria (27), 3.45% in Brahman and 3.21% in brown Swiss breeds (24), 1.4% in Santa Gertrudis bulls, 3.1% in Brahman bulls (28) and 3.6% in Ethiopia (22); but lower than the 18.8% obtained in Eastern Ethiopia (21), 12.9% and 8.9% in the Littoral, Cameroon (30, 16). These differences could be due to variations in the climatic condition of the study areas and breed of animals studied. Hypoplasia of the testes occurs in all farm animals but, certain breeds seem to be more prone to the testicular hypoplasia, as in Swedish highland bulls, with prevalence up to 25% (11), which is 5 times higher than the prevalence of testicular hypoplasia (5.8%) in this study. Hypoplasia of the testes was also reported in sheep (31) and goat (32). The prevalence of unilateral ($\chi2$=42.813; P<0.05) and bilateral ($\chi2$=48.083; P<0.05) testicular hypoplasia significantly varied with origin. Hence, majority of animals that were affected with unilateral testicular hypoplasia originated from Maroua followed by Ngaoundere. Animals affected with bilateral testicular hypoplasia majority originated from Maroua and Gazawa. Age, body condition, weight and slaughterhouses of bulls did not significantly affect the occurrences of unilateral and bilateral testicular hypoplasia (P>0.05). Similar to this study, it has been reported that testicular hypoplasia had no significant association with the ages of the bulls (22) which has a negative effect on semen quality and volume.

This study revealed that testicular degeneration had an overall prevalence of 2.5%. This result was inferior to 6.5% obtained by Eshetu in 2017 (21), 8.1% obtained by Migbaru et al. (22), 7.6 % obtained in Belgian Blue bulls and 10 % obtained in Holstein Frisian bulls in Belgium (33), but superior to 1% obtained by Kouamo & Eta in 2021 (16). This is because most adverse conditions like high ambient temperature or pyrexia from disease stress due to excessive physical work and also produced by other gross lesions like orchitis, epididymitis. All risks factors apart of slaughterhouses of the bulls did not significantly affect the occurrences of testicular degeneration (P>0.05) and bulls slaughtered in the NMA were more likely to be affected with testicular degeneration than other bulls in slaughterhouses.

Cryptorchidism was observed in 8 (1.3%) with only unilateral cryptorchidism recorded. Cryptorchidism can be unilateral or bilateral in type although, unilateral cryptorchidism is more common than bilateral cryptorchidism (34). This is in accordance with the findings of this study, where there was no case of bilateral cryptorchidism encountered .The current finding contradicted with earlier report that the cryptorchidism was rare in ruminants, with prevalence of 0.15-0.5% in bulls, goats and rams (34). Moreover, Kumi-Diaka et al. (35) reviewed and reported that prevalence of cryptorchidism in bulls was <0.5% and Silva et al. (24) reported that prevalence of cryptorchidism in Brahman and Brown Swiss bulls varied between 0.5-1%. The prevalence of cryptorchidism (1.3%) in this study contradicted the finding of Migbaru et al. (22) who reported 3.1% in central Ethiopia. But it agreed with the reports of St Jean et al. (36) and Adeyeye and Wakkala (37) who reported 1.7% in North America and 1.74% in Nigerian bulls, respectively. Yet, it is much higher than 0.05% in Canada (23). These variations might be due to dissimilarities in environmental conditions of the study areas such as level of anti-androgenic or toxic agents (38) and breed variation, as reported by St Jean et al. (36). Moreover, cryptorchidism affects spermatogenesis by inhibiting testicular thermoregulation.

Hematoma was observed in 10 (1.9%) specimens (penile and testicular). These results are inferior than 3% obtained by Kouamo and Eta (16), 9% obtained by Eshetu et al. (21) and 2.1% obtained by Migbaru (22). These differences could be due to trauma, harsh conditions and excessive physical torments leading to injury prior to bleeding which might cause rupture of superficial vessels of the prepuce. Bulls of 4-7 age group were seen to be more susceptible to testicular and penile hematoma than the other age groups.

Orchitis was occurred in 0.5% (n=3) cases of all bulls examined, which was much lower than 4.4% in Ethiopia (22)

and 1.32% in Algeria (27). However, Hopkins in 2007 reported that orchitis was infrequently diagnosed in bull (13). Only BSC of bulls significantly affected the occurrences of orchitis ($P<0.05$).

Epididymitis had an overall prevalence of 0.2%. These results were inferior to the 3.4% recorded in Ethiopia (22), 3% in Australia (28) and 2.5% in central Ethiopia (21). Furthermore, it did not significantly vary with any risk factor ($P>0.05$). Significantly varied difference in the prevalence of the epididymitis and age were observed ($P<0.05$), hence young bulls were more sensible to epididymitis.

The genital part with the greatest rate of occurrence of reproductive disorder was testes (19.3%), followed by the penis (11.8%), then comes the scrotum (1.5%) before the ducts (0.2%). Pathological conditions of testicular disorders (19.3%) were greater than earlier reports of Igbokwe et al. (32) 7.82% in Nigeria and Kouamo and Eta (16) 15.1% in Cameroon but comparable to the 17.8% recorded by Regassa (39) in Ethiopia in bucks.

Ngaoundere slaughterhouse was observed to have a high prevalence and was said to vary greatly compared to others. Bulls of the Ngaoundere slaughterhouse was 41.710 times more likely to have an abnormality compared to the Garoua slaughterhouse. However, commonly observed inflammatory and degenerative conditions of the genital organs such as sperm granuloma and mineralization, which were reported by several authors in other bulls breeds, were not encountered during the course of this study.

## Conclusion

A number of intact bulls have gross genital disorders which can affect the fertilization capability of breeding bulls. In general, 602 slaughtered bulls were examined at the abattoirs with 165 bulls affected with at least one genital disorder giving an overall prevalence of 27.4%, with 28.9%, 37%, 16.4% in Ngaoundere, Garoua and Maroua municipal slaughterhouses respectively. Data on reproductive capacity of bulls enables to realize breeding success through examination and timely detection of the reproductive problems and developing appropriate reproductive management strategies. Hence most of the pathological reproductive abnormalities detected in this study might be the cause of infertility in these animals and therefore the major reason for culling, moreover more attention should be given to reproductive management of bulls as the fertility of the bull is more important than that of any individual cows.

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## Conflict of Interest

The authors declared that there is no conflict of interest.

## Authors' contribution

All authors of this study have a complete contribution for data collection, data analyses and manuscript writing.

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