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Serum testosterone concentration in surgically castrated Black Bengal goats

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Abstract

The experiment was carried out to detect the blood serum testosterone concentration after orchiectomy in Black Bengal bucks (*Capra hircus*). Twelve apparently healthy bucks of 8 - 10 months old were randomly divided into two groups. Group A were castrated surgically through open uncover method and group B remained intact. Local analgesia (2% lidocaine hydrochloride) @ 0.5 mL per spermatic cord and 0.5 mL at the tip of each scrotum were applied initially in all bucks. After aseptic preparation, incision was given at the tip of the scrotum and tunica vaginalis was incised to exteriorize the testis. Anchoring was done at the spermatic cord followed by orchiectomy. The scrotal raphe was incised to reach the other testis and the same procedure was followed. Blood samples were collected from jugular vein before orchiectomy and on day 30. In the castrated bucks, serum testosterone concentration was significantly ($P<0.01$) decreased from day 0 (6.1 ± 0.2 ng/mL) to day 30 (0.6 ± 0.0 ng/mL), which confirmed the efficacy of castration. (*Bangl. vet*. 2016. Vol. 33, No. 2, 71 – 77)

Introduction

Castration of male animals is the removal of the testicles or making the testicles nonfunctional (Abid and Al-Baghdady, 2013). Castration can involve obliteration of blood supply to the testes by crushing the blood vessels, cutting, vaccinating or elevating temperature of the testes (Frandson and Spurgeon, 1992). Castration is performed to prevent the production of androgens and spermatogenesis (Baird and Wolfe, 1998; Gilbert and Fubini, 2004), to prevent unwanted mating and mounting and injuries accompanied or to treat testicular or inguinal pathology (Searle *et al*., 1999; Price *et al*., 2005; Edwards, 2008), to decrease aggressiveness and to make the animal docile for easy management (Kent *et al*., 1996; Stafford, 2007). In food animals, castration can improve quality and taste of meat, and feed efficiency (Thompson, 2000; Anderson, 2007) and reduce goaty smell in the meat (Merkel and Dawson, 2008). Goat meat is otherwise tainted if kids are slaughtered after more than four months of age (Devendra and McLeroy, 1988). Methods of castration can be classified into physical, chemical, and hormonal.

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Testes act as the main source of testosterone (Starr *et al*., 2012). The present research determined blood serum testosterone concentrations after castration.

Materials and Methods

Ethical statement

Orchiectomy was done aseptically. Local analgesia was done prior to orchiectomy. Painkiller was administered as post-castration pain management.

Experimental site

The research was carried out in the Research Animal Farm Laboratory, Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh, from July 2016 to November 2016.

Study population

Twelve male Black Bengal goats (bucks) 8 – 10 months old were purchased from local market. The bucks weighed 12 – 15 kg and no visible abnormalities or disease were detected. The bucks were kept in quarantine for 14 days and were supplied with grass, concentrate feed and water. The goat-shed was regularly washed and disinfected with 0.1% potassium permanganate solution. Ivermectin 0.2 mg/kg was injected subcutaneously to each buck. Tetanus toxoid vaccine and PPR vaccine were administered to each buck before the experiment.

Experimental protocol

The bucks were acclimatized and divided into two groups of 6, Group A were castrated, group B were control. ELISA was used to determine the blood serum testosterone concentrations.

Observation of clinical parameters

Rectal temperature, heart rate and respiration rate were measured before orchiectomy (day 0) on day 1 to 7, on day 15 and day 30 post-castration.

Orchiectomy procedure

Open uncover method was applied. Initially local analgesia was done using 2% lidocaine hydrochloride @ 0.5 mL per spermatic cord and @ 0.5 mL at the tip of the scrotum. The operation site was shaved, scrubbed with soapy water and painted with tincture of iodine. After aseptic preparation, incision was made at the tip of scrotum and tunica vaginalis was incised. The testis was pressed firmly and spermatic cord was exteriorized. Spermatic cord was anchored using chromic catgut no. 1 followed by orchiectomy distal to epididymis. The scrotal raphe was incised to reach the other testis and same procedure was followed. Antibiotics (Procaine penicillin 30 lac IU and Benzyl penicillin 10 lac IU; Pronapen®, Renata Ltd., Bangladesh) antihistaminic (Pheniramine maleate @ 1.0 mg/Kg body weight; Asta-vet®, The Acme Laboratories

Ltd., Bangladesh) and anti-inflammatory drugs (Ketoprofen dosed @ 3.0 mg/Kg body weight; Ketovet®, Techno Drugs Ltd., Bangladesh) were administered.

Hormonal assay of testosterone using ELISA technique

Blood serum collection

Briefly, 2 mL blood samples were collected from left jugular vein following aseptic measures, before orchiectomy and on day 30 using vacuum blood collection tube. Blood samples were centrifuged @ 3000 rpm for 30 minutes. Afterwards, serum were collected in Eppendorf tubes and kept at -20°C.

ELISA procedure

Serum samples were equilibrated at room temperature for about 30 minutes. The testosterone ELISA kit was purchased from Nova TecImmunodiagnostica GmbH (Germany). For testosterone assay, biotinylated antibody, enzyme-antigen conjugate and a native antigen containing serum were used as the essential reagents. The biotinylated antibody is the anti-testosterone biotinylated purified rabbit IgG conjugate. Horseradish peroxidase is the enzyme-antigen conjugate. Standard instructions were followed. Testosterone concentration was measured in ng/mL. Calculations were done using the formula $y = a + b \times x$ from a standard curve (Fig. 1) with seven standards supplied with the testosterone ELISA kit box. At 450 nm, the optical density (OD) values of the samples and standards were determined using the spectrophotometer (ELISA reader) Ultra Microplate reader (Biotek Instruments, Inc., Winooski, USA).

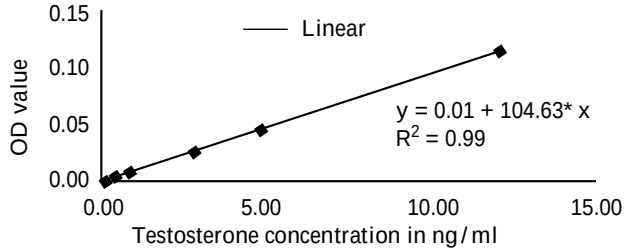

Fig. 1: Standard curve for the determination of testosterone concentration in serum (OD = Optical density; R^2 = Coefficient of determination).

Statistical analysis

One way analysis of variance (ANOVA) was applied, using the software IBM SPSS Statistics, Version 20. The level of significance was considered at $P<0.05$.

Results and Discussion

For many years, orchiectomy has been a standard method for sterilization of male animals. However, several drawbacks have been associated with this procedure such as high cost, time consumption, need for postoperative care, risk of post-operative

complications, small-scale application, the requirement of anaesthesia, medical equipment, a sterile surgical suite, a trained Veterinary Surgeon, and long recovery time (Jana and Samanta, 2007).

Rectal temperature, heart rate and respiration rate before and after orchiectomy in the two groups are presented in Table 1, 2 and 3, respectively. There were slight increases in rectal temperature, heart rate and respiration rate immediately after orchiectomy in group A, but these deviations were insignificant (P>0.05) when compared to the control. Previous studies reported that there is an increasing cortisol response to castration with increasing age (King *et al*., 1991; Robertson *et al*., 1994). Regardless of the castration technique and the age of the patient, all ruminants benefit from the use of systemic analgesia (e.g., a non-steroidal anti-inflammatory drug – NSAID), and/or a local anaesthetic (Stafford *et al.,* 2002; Stafford and Mellor, 2005). The fact that temperature, heart rate and respiratory rate did not differ significantly between castrated and control suggests that pain was well controlled.

Table 1: Rectal temperatures (°F) (Mean ± SE) of Black Bengal bucks

Days	Group A	Group B
0	102.7 ± 0.3	103.1 ± 0.2
1	103.9 ± 0.6	103.1 ± 0.1
2	103.2 ± 0.2	103.1 ± 0.1
3	102.9 ± 0.4	103.3 ± 0.2
4	102.6 ± 0.2	103.1 ± 0.2
5	102.8 ± 0.4	103.4 ± 0.2
6	102.9 ± 0.3	103.1 ± 0.2
7	102.9 ± 0.4	103.1 ± 0.1
15	103.0 ± 0.5	103.2 ± 0.3
30	102.9 ± 0.3	103.0 ± 0.2

Table 2: Heart rate (mean ± SE) of Black Bengal bucks

Days	Group A	Group B
0	105.3 ± 4.8	114.0 ± 2.7
1	111.7 ± 5.4	103.0 ± 2.7
2	111.0 ± 1.5	108.7 ± 3.5
3	106.0 ± 5.3	103.0 ± 8.6
4	112.0 ± 4.0	105.0 ± 2.7
5	107.3 ± 2.9	110.7 ± 3.5
6	105.3 ± 6.0	100.0 ± 4.2
7	107.0 ± 5.5	107.7 ± 6.2
15	104.7 ± 4.8	100.0 ± 5.3
30	108.0 ± 2.3	102.0 ± 4.3

Table 3: Respiratory rate (Mean ± SE) of Black Bengal bucks

Days	Group A	Group B
0	30.3 ± 3.5	26.7 ± 3.71
1	38.3 ± 3.8	24.0 ± 0
2	34.0 ± 2.5	25.7 ± 2.9
3	30.7 ± 4.2	25.3 ± 3.8
4	26.3 ± 5.8	27.0 ± 4.0
5	26.3 ± 2.4	23.3 ± 3.3
6	28.3 ± 0.3	26.0 ± 5.3
7	24.0 ± 2.9	25.0 ± 3.5
15	24.3 ± 3.4	22.0 ± 3.0
30	25.5 ± 2.5	24.3 ± 2.7

The testosterone concentration in serum markedly decreased on day 30 post-castration (Fig. 2). The serum testosterone concentration in group A declined significantly ($P<0.01$) from 6.1 ± 0.2 ng/mL on day 0 before to 0.55 ± 0.0 ng/mL on day 30 after castration. In the control group B, the testosterone concentration in the blood serum was 6.4 ± 0.2 ng/mL and 6.5 ± 0.3 ng/mL on day 0 and day 30, respectively. The difference on day 30 was significant ($P<0.01$). Previous studies gave similar results (Cai *et al*., 2015; Sosic-Jurjevic *et al*., 2012).

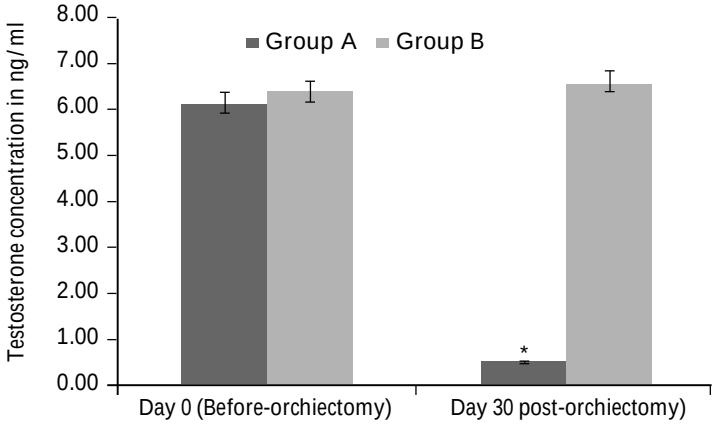

Fig. 2: Testosterone concentration in blood serum before orchiectomy on day 0 and on day 30 post-orchiectomy.

The data are expressed as mean ± SEM; *$P<0.05$, significantly different as compared to group B on day 30.

It can be concluded that testosterone concentration in blood serum could be used as a major determinant in evaluating the efficacy of castration in Black Bengal bucks.

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