

Short Communication

Preliminary study on the effect of castration and testosterone replacement on testosterone level in the New Zealand male rabbit

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To study the effect of castration and testosterone replacement on the testosterone level of the New Zealand rabbit, 16 apparently healthy adult male rabbits were used. The animals were divided into four groups with each group having four rabbits. The first group served as the control group. The rabbits in the second group were unilaterally castrated, while those in the third group were bilaterally castrated. The rabbits in the fourth group were bilaterally castrated and then had testosterone replacement. The normal value of plasma testosterone in the male New Zealand rabbit was 7.17 ± 0.72 nmol/L. There was a sharp significant ($p < 0.05$) drop in the level of testosterone one week after unilateral castration and by 2nd week, it returned to the pre-castration value. The plasma level of testosterone also dropped significantly ($p < 0.05$) after one week of castration in the bilaterally castrated and bilaterally castrated with testosterone replacement groups, and by 2nd week in the latter group (bilaterally castrated with testosterone replacement), the plasma level had risen to a slightly higher value than pre-castration value. In the bilaterally castrated group, the plasma level of testosterone also rose but was lower than the pre-castration value. The study shows that the unilateral castration does not permanently alter the plasma testosterone level as does the bilateral castration.

Key words: Castration, New Zealand rabbit, testosterone, testosterone replacement.

INTRODUCTION

There are numerous publications on the testosterone level in the male New Zealand rabbits (Haltmeyer and Eik-nes, 1969; Castro et al., 2002; Kasilima et al., 2004). However, there is currently a dearth of information on the testosterone level in the male New Zealand rabbits in the hot and humid environment. Also, there is a paucity of knowledge on the effects of castration on the testosterone level of these exotic breed of rabbit in Nigeria. There is also a scarcity of information on the effect of testosterone replacement on the testosterone level of this breed of rabbit. Testosterone plays an essential role in the development of the normal male and in the maintenance of many male characteristics, including muscle mass and strength, bone mass, libido,

potency and spermatogenesis. Androgen deficiency occurs with disorders that damage the testes, including traumatic or surgical castration (primary testicular failure) or disorders in which the gonadotropin stimulation of the testes is reduced (hypogonadotropic hypogonadism) (Winters, 1999). There have been reports on the effects of castration on plasma enzymes and electrolyte in the West African dwarf goats (Oyeyemi et al., 2000). This report did show the effect of castration on the testosterone level. Therefore in this work, we reported the effect of castration and testosterone replacement on the testosterone level in the male New Zealand rabbits.

MATERIALS AND METHODS

16 apparently healthy adult male rabbits were purchased from a commercial rabbitry in Ibadan, Nigeria. The animals were kept in the Experimental Animal House, Faculty of Veterinary Medicine, University of Ibadan, Nigeria. They were fed with commercially

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Table 1. The effect of castration and testosterone replacement on plasma levels of testosterone (nmol/L)

Week	0 (n = 4)	1 (n = 4)	2 (n = 4)	3 (n = 4)
Unilateral castration	7.50±0.58	5.33±1.16*	8.00±2.00	7.20±0.45
Bilateral castration	7.20±0.45	4.50±1.29*	6.00±2.71	6.33±1.53
Bilateral castration with testosterone replacement	7.00±1.00	5.25±1.71*	8.75±0.96	8.50±1.00

*Value significantly different ($p < 0.05$) from the value obtained at pre-castration (week 0).

prepared feed purchased from Ladokun Feeds Limited, Ibadan, Nigeria (21% protein; 3.5% fat; 6% fiber; 0.8% calcium; 0.8% phosphorus) and they had unrestricted access to water. The animals were allowed to acclimate to their new environment for four weeks.

Experimental design

The rabbits were divided into four groups with each group having four rabbits. The first group served as the control group. The rabbits in the second group were unilaterally castrated, while those in the third group were bilaterally castrated. The rabbits in the fourth group were bilaterally castrated and then had testosterone replacement. The duration of the experiment was six weeks. The first two weeks was used to obtain the standard testosterone value for the hot humid environment from the rabbits in the control group.

After two weeks, the rabbits were castrated and the effect of castration and testosterone replacement on testosterone level was observed over the next four weeks. The fourth group that had testosterone replacement was given 2.5 mg/kg of testosterone propionate (Scanpharm AC, Copenhagen, Denmark) at 48 hourly through the intramuscular route. The unilateral and bilaterally castrated animals were given distilled water through the intramuscular route.

Four weeks after castration, blood samples were then taken from the animals in Groups 2, 3 and 4 with the view of determining the different testosterone levels.

Castration

The open method of castration was used for this study. Each rabbit was restrained in dorsal recumbency on a surgical table. The scrotal area was disinfected with methylated spirit. 1 ml of 2% lignocaine hydrochloride solution, a local anesthetic, was injected through the tense scrotal skin into each testicle to be removed. The scrotal skin had been earlier desensitized by local subcutaneous infiltration of the local anesthetic around the neck of scrotum (Hall, 1979). Each testicle was then held tightly against the scrotal skin to open up the scrotum. The incision which was about 1 cm wide penetrated the tunica vaginalis which was then retracted to allow the testicles to come out. Its attachment to the scrotal wall via the gubernaculum at the cauda epididymal end was severed together with the spermatic cord. A three-pronged ligature and clamping technique was employed to ensure haemostasis. 1 ml of a combination of antibiotic containing penicillin and streptomycin was then given parenterally and also infused into the scrotum. This same procedure was repeated for the other testicle during bilateral castration.

Blood collection

The rabbits were anaesthetized with ether before collecting the blood samples. 5 ml of blood was collected from the orbital sinus

with heparinized capillary tube into bottles that were having lithium heparin as the anticoagulant. The different blood samples were then centrifuged at 3,000 r/min for 10 min and plasma samples were then decanted from the centrifuged blood samples into plain bottles. Hormonal assay was done to determine the testosterone levels in each plasma sample.

Testosterone assay

Testosterone Enzyme Immuno Assay (EIA) kit was supplied by Immunometrics (UK). The testosterone assay was then carried out using the technique that was earlier described (Olayemi, 2007).

Software of Statistical Package of Science and Social Sciences was used for the statistical analysis. Statistical analyses were made between the weeks in the groups. Probability of $p < 0.05$ was considered significant.

RESULTS

The value obtained for the testosterone level in male New Zealand rabbit was 7.17 ± 0.72 nmol/L. Table 1 shows the effect of castration and testosterone replacement on testosterone levels in the plasma. There was a sharp significant ($p < 0.05$) drop in the level of testosterone one week after unilateral castration and by 2nd week, it returned to the initial level before castration. Level of testosterone dropped significantly ($p < 0.05$) after one week of castration in the bilaterally castrated and bilaterally castrated with testosterone replacement groups, and by 2nd week in the latter group (bilaterally castrated with testosterone replacement), the plasma level had risen to a slightly higher value than the pre-castration value, although it was not significantly higher. In the bilaterally castrated group, the plasma level of testosterone also rose to a level comparable to the pre-castration value.

Table 2 compares the testosterone level in New Zealand rabbit of the present study with other species of domestic animals. The rabbit has the highest value of testosterone.

DISCUSSION

In the present study, the plasma testosterone value obtained for the New Zealand rabbit was 7.17 ± 0.72 nmol/L. This value is similar to that obtained in the same breed of rabbit in the temperate region (Castro et al., 2002). The present study was undertaken because the

Table 2. Testosterone levels (nmol/L) in the New Zealand rabbit and other domestic animals.

Species	Testosterone level	Source
Rabbit	7.17±0.72	Present study
Rat	4.05	Raji (1995)
Boar	4.00±0.50	McDonald and Pineda (1989)
Bull	6.70±0.20	McDonald and Pineda (1989)
Stallion	2.10±0.10	McDonald and Pineda (1989)
Ram	5.22±0.66	McDonald and Pineda (1989)
Goat	6.22±0.70	McDonald and Pineda (1989)
Dog	2.20±0.70	McDonald and Pineda (1989)
Cat	6.33±0.35	McDonald and Pineda (1989)

importance of testosterone to the male animal cannot be overemphasized. The functions of testosterone can be broadly classified into two. The first is the androgenic function which includes the development of secondary male characteristics. The second is the anabolic function which involves the promotion of protein synthesis (Raji, 1995).

In the present study, castration significantly decreased the plasma testosterone levels in the three groups under study (unilateral castration, bilateral castration and bilateral castration with testosterone replacement). These decreases observed in the three groups may have been due to the removal of one or more testicles which is the main source of testosterone in these animals. However, there was total recovery of the pre-castration level after two weeks in the unilaterally castrated group. Similarly, Berger et al. (1978) observed that the plasma testosterone level in the 30 day old unilaterally castrated New Zealand rabbit was significantly higher than the value in the pre-castrated rabbits. The total recovery observed in unilaterally castrated group may have been as a result of the compensatory increased production of the hormone by the testis that was still intact. Also, there was total recovery in the bilaterally castrated with testosterone replacement. The exogenous administration of testosterone in the bilaterally castrated with testosterone replacement group may be responsible for the recovery. Winters (1999) had underscored the importance of testosterone replacement in the treatment of hypogonadism in humans. Androgen replacement is available as intramuscular depot injections of testosterone esters, oral tablets of testosterone derivatives and transdermal patches. For most patients, androgen replacement therapy with testosterone is a safe and effective treatment for testosterone deficiency.

However, the plasma level of testosterone of the rabbits in the bilaterally castrated group did not return to the pre-castration level. The slight increase in the level of plasma testosterone observed in the second and third weeks of the experiment in this group may have been due to the production of testosterone by the adrenal cortical cells of the adrenal gland.

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