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HAEMATOLOGICAL CHANGES ASSOCIATED WITH SURGICAL CASTRATION IN RED SOKOTO GOATS

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ABSTRACT

This study investigated the haematological changes associated with surgical castration in Red Sokoto goats. Ten Red Sokoto bucks between the ages of 3-5 months, weighing 8.55 (±1.01) kg were used to study the influence of surgical castration on haematological indices. The bucks were randomly assigned into 2 groups of 5 bucks each. Bucks in group A were surgically castrated while those in group B were not castrated. Blood samples were collected from all bucks in the two groups weekly for 4 weeks, post castration. Following castration, there was no significant (p>0.05) variation in total white blood cell count, differential white blood cell count and platelet characteristics between the two groups. The castrated bucks had a significantly lower (P<0.05) packed cell volume, red blood cell count, red blood cell distribution width at week 1, and haemoglobin (p<0.05) at weeks 1 and 2 post-castration. Variation in erythrocytic corpuscular indices between the two groups was not significant (p > 0.05) throughout the study period. This study has demonstrated that significant changes, characteristic of anaemia, may occur within 28 days post castration in Red Sokoto bucks.

Keywords: *Castration, Haemogram, Red Sokoto Goats*

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INTRODUCTION

Castration of apparently healthy goat bucks is among the most commonly performed surgical procedures in small ruminants. Bucks are castrated for management and production reasons. Castration in bucks involves cutting off blood supply to the testis or total removal of the testis [1]. The most frequently used techniques are the bloodless castration using elastrator bands or the Burdizzo emasculatome, chemical and surgical methods [2]. Each method has advantages and disadvantages, and this stems from the diverse effect of the procedure on the physiology of the animal. Castration of goats and other mammals has been shown to affect their haemogram [3,4,5,6] but there are no reports in available literature on the influence of surgical castration on the haematology of Red Sokoto goats. This study was therefore conducted to evaluate the haematological changes associated with surgical castration in Red Sokoto bucks.

MATERIALS AND METHODS

Experimental Animals

Ten apparently healthy intact Red Sokoto bucks aged 3-5 months and weighing 8.55 (±1.01) kg purchased from Sokoto Market were used for this study. The goats were housed in the Small Ruminant Research Unit of the Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto under hygienic conditions. The bucks were acclimatized for 3 weeks during which they were prophylactically treated with ivermectin (200 µg/kg twice at 12 days interval) for arthropod and helminth infections, ciprofloxacin (2 mg/kg for 3 consecutive days) for bacterial infections, and amprolium (55 mg/kg/day for 5 consecutive days) for protozoal infections. The bucks were fed on wheat offal, bean husk and groundnut hay *ad libitum*. Water was provided *ad libitum* throughout the study period.

Experimental Design

The bucks were randomly divided into two groups (A and B) of five each and individually identified using a tag prior to castration. The bucks in group A were surgically castrated while those in group B served as the uncastrated controls. Surgical castration was performed using the method described by Tibary and Van Metre [7].

Sample Collection and Analysis

Whole blood (3 ml) for haematology was collected aseptically from the jugular vein of each buck for 4 weeks post castration. Haematological parameters such as packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) count, RBC indices, total and differential white blood cell (WBC) counts and platelets characteristics were determined using the Full Automatic Blood Cell Counter (PCE-210; ERMA Inc. AGD Biomedicals [P] Limited, India) following the manufacturer's instructions.

Data Analysis

Unpaired t-test with Welch correction was used to compare data of all the parameters from the castrated and intact bucks. Values were expressed as means ± standard deviations. The difference was considered significant at values of $p<0.05$. Statistical analysis was performed using GraphPad InStat for Windows, (version 3.05).

RESULTS

The results of the total leucocyte and differential leucocyte counts are presented in Table 1. There were no significant differences ($p > 0.05$) between the castrated and uncastrated in the total WBC count, total granulocytes, lymphocytes and monocytes counts all through the study. However, the mean lymphocytes count of the castrated bucks was numerically lower than that of the intact bucks throughout the study period.

The effects of surgical castration on PCV, RBC count, Hb concentration and erythrocytic corpuscular indices are presented in Table 2. The castrated bucks had significantly lower (p<0.05), PCV and RBC (p<0.05) only at week 1 post castration. The castrated bucks had significantly lower (p< 0.05) Hb concentration at weeks 1 and 2 post castration. The differences in the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) between the two groups were not significant (p > 0.05) throughout the study period. The castrated bucks had a significantly lower (p < 0.05) red blood cell distribution width only at week 1 post-castration (Table 2).

The platelet characteristics of castrated and uncastrated Red Sokoto bucks are as shown in Table 3. The differences in platelets count, platelet crit value, mean platelet volume and platelet dimension width between the two groups were not statistically significant (p > 0.05) throughout the study period.

Table 1. Total leucocyte and differential leucocyte count of castrated and uncastrated Red Sokoto bucks

Parameters		Weeks post castration			
		1	2	3	4
Total WBC ($\times10^3/\mu l$)	Castrated	52.06±16.03[a]	44.12±15.85[a]	44.16±14.28[a]	47.76±9.54[a]
	Uncastrated	53.98±10.92[a]	48.24±16.30[a]	53.38±22.77[a]	45.43±10.62[a]
Total Granulocytes ($\times10^3/\mu l$)	Castrated	16.54±6.77[a]	13.24±6.62[a]	15.12±8.20[a]	17.60±3.39[a]
	Uncastrated	13.88±3.67[a]	14.54±7.17[a]	15.10±6.19[a]	15.78±4.54[a]
Lymphocytes ($\times10^3/\mu l$)	Castrated	31.96±8.55[a]	27.62±9.18[a]	24.64±5.11[a]	26.74±4.59[a]
	Uncastrated	36.98±9.03[a]	29.44±14.66[a]	32.25±15.66[a]	27.00±9.51[a]
Monocytes ($\times10^3/\mu l$)	Castrated	3.58±1.95[a]	3.26±1.54[a]	4.42±2.45[a]	3.40±1.65[a]
	Uncastrated	3.08±0.81[a]	4.24±0.92[a]	5.88±2.89[a]	2.65±0.83[a]

[a]No significant differences between the means of the castrated and uncastrated bucks (P>0.05)

DISCUSSION

The result of this study indicated that surgical castration of Red Sokoto bucks has no significant (P>0.05) effect on total WBC count, total granulocyte count, as well as lymphocyte and monocyte counts. However, a consistent but apparently lower lymphocytes count was recorded in the castrated group throughout the study period. It is possible that the low number of experimental animals in the groups may have contributed, in part, to the lack of significant differences in the parameters investigated during the study. Surgical castration elicits physiological stress, inflammatory reactions, and stress known to be associated with lowering of lymphocyte counts and consequent suppression of immune function.[8] The stress induced by castration might have triggered a rise in cortisol secretion via stimulation of the hypothalamic hypophyseal adrenal axis [9]. A rise in plasma cortisol level above the physiological range has immunosuppressive effect. This may also account for the low lymphocyte count recorded in the castrated bucks throughout the study period. Castration has also been reported to cause increased hepatoglobin and decreased gamma-interferon which exert a suppressive effect on lymphopoiesis, and the immune system (cell –mediated immunity) [10]. The lower lymphocyte counts observed in the castrated bucks in this study is consistent with the findings of Mohammad *et al*. [4] and Hassan [5] who reported a

non significant decrease in lymphocyte count following surgical castration in Awassi lambs and a significant decrease in lymphocyte count following surgical castration in Wistar rats, respectively.

Table 2. Packed cell volume, total red blood cell count, haemoglobin and erythrocytic indices of castrated and uncastrated Red Sokoto bucks

Parameters		Weeks post castration			
		1	2	3	4
PCV (%)	Castrated	20.56±1.04[a]	22.40±2.44[a]	21.85±1.48[a]	25.70±3.28[a]
	Uncastrated	24.58±2.84[b]	25.20±1.66[a]	21.85±1.48[a]	25.70±3.28[a]
RBC ($\times 10^6/\mu l$)	Castrated	10.46±0.78[a]	12.71±0.31[a]	12.48±0.71[a]	12.61±0.73[a]
	Uncastrated	12.74±0.90[b]	13.44±0.61[a]	12.82±1.14[a]	11.81±.088[a]
Hb concentration	Castrated	8.10±0.53[a]	8.70±0.50[a]	8.36±0.13[a]	8.74±0.40[a]
(g/dl)	Uncastrated	9.48±0.98[b]	9.50±0.47[b]	8.30±0.90[a]	8.68±0.93[a]
MCV (fl)	Castrated	19.68±1.00[a]	17.60±2.33[a]	17.55±2.01[a]	20.36±3.15[a]
	Uncastrated	19.24±1.86[a]	18.74±1.25[a]	19.45±1.05[a]	21.98±0.65[a]
MCH (Pg)	Castrated	7.76±0.51[a]	6.83±0.56[a]	6.68±0.32[a]	6.90±0.52[a]
	Uncastrated	7.40±0.27[a]	7.04±0.46[a]	6.45±0.25[a]	7.30±0.57[a]
MCHC (g/dl)	Castrated	39.38±1.29[a]	38.95±2.42[a]	38.4±2.88[a]	34.34±3.07[a]
	Uncastrated	38.74±4.26[a]	37.74±2.95[a]	36.12±1.23[a]	33.38±3.41[a]
RBC Distribution	Castrated	28.49±2.41[a]	33.47±2.33[a]	32.43±3.52[a]	32.70±3.70[a]
Width (%)	Uncastrated	33.24±2.54[b]	34.74±1.59[a]	32.10±2.18[a]	27.15±5.44[a]

[ab]Pairs of means with different superscript are significantly different ($p<0.05$).

Table 3: Platelet characteristics of castrated and uncastrated Red Sokoto bucks

Parameters		Weeks post castration			
		1	2	3	4
Platelets	Castrated	502±78.46[a]	446.25±162.45[a]	404.50±34.20[a]	655.40±145.02[a]
($\times 10^3/\mu l$)	Uncastrated	396±70.16[a]	321.20±149.04[a]	254.75±150.52[a]	451.00±265.15[a]
Platelet Crit	Castrated	0.28±0.06[a]	0.25±0.10[a]	0.23±0.02[a]	0.39±0.11[a]
Value (%)	Uncastrated	0.22±0.04[a]	0.18±0.09[a]	0.13±0.10[a]	0.28±0.16[a]
Mean Platelet	Castrated	5.55±0.19[a]	5.55±0.24[a]	5.58±0.15[a]	5.82±0.79[a]
Volume (fl)	Uncastrated	5.56±0.11[a]	5.66±0.11[a]	5.03±0.87[a]	6.40±0.12[a]
Platelet	Castrated	684.25±0.17[a]	684.23±0.13[a]	684.23±0.13[a]	683.92±0.36[a]
Dimension	Uncastrated	683.92±0.36[a]	683.84±0.40[a]	683.93±0.24[a]	683.93±0.46[a]
Width (fl)					

[a]No significant differences between the means of the castrated and uncastrated bucks ($p>0.05$)

The RBC count, PCV, and red cell distribution width of the castrated group were significantly lower ($p < 0.05$) than that of the uncastrated group at one week post castration. The castrated bucks also had a significantly lower ($p < 0.05$) Hb concentration at weeks 1 and 2 post castration, but other variations in those parameter were not significant thereafter. This observation may be as a result of haemorrhage due to the surgical procedure. Testosterone enhances erythropoiesis at the level of the kidney by stimulating renal erythropoietin secretion [11]. Therefore, it is possible that a reduction in plasma testosterone level caused by the absence of testes may also have had a depressive effect on erythropoiesis and possibly also partly account for the observed reduction in PCV and Hb concentration. This effect may be mild and transient as indicated by the results of this study and that of Olaifa *et al*. [6], who reported a non significant fall in PCV, Hb concentration, and RBC count upon castration in West African Dwarf bucks using Burdizzo, and a return to normal values of these parameters by the end of the fourth week after castration.

A non significant ($p > 0.05$) variation in the MCV, MCH and MCHC was observed between the two groups throughout the study period. The erythrocytic indices are derivatives of the PCV, RBC count and Hb concentration. Although significant variations were observed in these parameters (PCV, RBC and Hb concentration) at weeks 1 and 2 post castration, their absolute values were within the physiological ranges. This indicates that surgical castration as well as the absence of testicular androgens may not induce actual anaemia in Red Sokoto bucks within one month of castration. This result agrees with the findings of Olaifa *et al.* [6] but contrasts with that of Hassan [5], who reported a significant increase in MCV and MCH following surgical castration in goats.

The platelet counts, platelet critical value, mean platelet volume and platelet dimension width showed a non significant ($p > 0.05$) variation between the two groups throughout the study period. Testosterone is known to have a thrombopoietic effect and high level of the hormone induces intravascular clot formation [12]. Castration causes significant decrease in plasma testosterone below the bioactive level [13] and this probably will have a depressive effect on thrombopoiesis and clotting time. The non significant variation in platelet characteristic observed in this study may be specie related or it could be that the manifestation of the effects of testosterone on platelet characteristics does not occur within one month of castration.

CONCLUSION

Based on the findings of this study, it is concluded that surgical castration in Red Sokoto bucks induced alterations in the PCV, RBC count and Hb concentration during the first and second weeks post castration.

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