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Haematological and biochemical parameters of West African Dwarf (WAD) bucks castrated by the Burdizzo method

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ABSTRACT

The response to the closed method of bilateral castration using Burdizzo castrator was investigated in six West African Dwarf (WAD) goats at the Teaching and Research Farm, University of Ibadan, Nigeria for 4 weeks. Urea significantly increased ($P<0.05$) from the first week of experiment until the third when it decreased significantly ($P<0.05$) and it was again elevated in the final week of the study. Creatinine also increased significantly ($P<0.05$), without further changes until the fourth week of the study. ALP decreased significantly ($P<0.05$) from the first to the third week of the study and thereafter increased significantly. ALT did not change significantly until the third week when it increased ($P<0.05$) and then decreased during the last week of the study. This was still higher than the value at pre-orchidectomy. Serum protein levels increased and decreased without significant differences, but were later significantly ($P<0.05$) elevated to the pre-castration level. Although the albumin fraction continued to decrease until the 3rd week, this was not significant. A significant increase ($P<0.05$) was then observed in the last week of the study. Globulin fraction decreased significantly and remained so until the end of the study. The haematological values showed no significant increase in PCV, Hb, RBC and other indices of measurement, but the WBC count showed a significant increase ($P<0.05$) upon castration and remained elevated until the 4th week when it returned to within a normal range. This study showed that bloodless castration had a milder effect on serum profiles and might be a safer alternative to surgical castration in WAD goats, especially where protein deficiencies or hepatocellular insufficiency exists.

Key words: haematology, biochemistry, West African Dwarf bucks, Burdizzo castration

Introduction

The different methods of castration may be classified into three major groups: physical, chemical and immunological. Physical methods used to castrate animals include surgical removal of the testicles (JENNINGS, 1984), the application of rubber rings or tightened

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latex bands (referred to as banding) (FELL et al., 1986; CHASE et al., 1995), and the use of a Burdizzo method to crush the testicular cords (ROBERTSON et al., 1994). In small ruminants, castration by surgical or non-surgical means has been used to improve the quality and palatability of meat (JEREMIAH, 2000).

Castration has been shown to elicit physiological stress, inflammatory reactions (indicated by acute phase proteins), pain-associated behaviour, suppression of immune function, and a reduction in performance (MOLONY et al., 1995; FISHER et al., 1996 and 1997; AHMED and AHMED, 2011) to varying degrees.

The effects of surgical bilateral castration on some serum enzymes and proteins in WAD bucks and lambs have been investigated (SHUTT et al., 1988; OYEYEMI et al., 2000; MOHAMMAD et al., 2008). Surgical castration has been reported to result in peritonitis, but the effects of bloodless castration have not been elucidated.

This study was therefore carried out to determine the effects of bloodless castration using Burdizzo castrator, on the haematological and biochemical parameters of indigenous WAD. The results of this study may further determine the difference in the effects of both methods and help in deciding which of them is safer in castration.

Materials and methods

The animals used in this experiment were acquired from a local market in Ibadan and acclimatized for one week before commencement of blood sampling.

Six West African Dwarf bucks aged between six months to one year and weighing between 8 to 14 kg were used for this study.

The individual pens were cleaned and disinfected prior to the arrival of the animals. Upon arrival, they were examined and dewormed using Levamisole and de-ticked using Asuntol, an organophosphate compound. They were also placed on antibiotic therapy for 5 days by intramuscular administration and fed daily on a 12% protein ration and fresh water ad libitum.

Collection of blood samples. 7.5 mL of blood was collected by jugular venipuncture using a sterile needle and syringe. 5 mL of it was put into commercially prepared tubes containing EDTA as the anticoagulant, while 2.5 mL was put in separate tubes without an anticoagulant. The first set of blood samples were collected prior to castration and then weekly for 4 weeks after castration. The samples were taken before 10 am in the morning when the animals were calm and the ambient temperature was low. Thereafter, the samples were immediately taken to the laboratory for analyses.

Bloodless castration procedure. The bucks were restrained by an assistant with the hind limbs apart and scrotal area exposed to the surgeon who stood facing the assistant in order to control the correct application of the Burdizzo castrator. The instrument was applied laterally onto the scrotal neck by the assistant behind the goat. The cord was held

laterally in the scrotal neck by first finger and thumb, with the second hand directing the position of the jaws slowly, until they were about 8-10 mm apart to grip the skin and cord firmly. Rapid closure was ordered and maintained for 15-30 seconds, during which the surgeon ensured that cord was correctly crushed.

Analyses of blood samples. Using standard techniques as reported by (JAIN, 1986), the packed cell volume (PCV), red blood cell counts (RBC), haemoglobin concentration (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), total white blood cell counts (WBC) were determined.

The concentrations of ALT and AST in the sera were determined using commercial kits based on the method by HENRY et al. (1960). ALP level was determined electrophotometrically using P-nitrophenol as substrate.

Serum total protein and albumin levels were determined by the Biuret method, as described by DOUMAS et al. (1971).

Results

Table 1. Haematological values of WAD bucks before and after bloodless bilateral castration using Burdizzo method

Parameter, normal values	Pre-castration Week 0	Post castration			
		Week 1	Week 2	Week 3	Week 4
PCV (%) 19-40	31.00 ± 2.28 ^{a}	24.17 ± 2.37^{a}	26.33 ± 2.14 ^{a}	30.50 ± 2.31 ^{a}	29.50 ± 2.68 ^{a}
Hb (g/dL) 8-16	11.03 ± 0.82 ^{a}	8.63 ± 0.85 ^{a}	9.42 ± 0.77 ^{a}	10.95 ± 0.79 ^{a}	10.70 ± 1.00 ^{a}
RBC ($\times 10^6/\mu L$) 7-21	15.13 ± 0.77 ^{a}	12.60 ± 1.45 ^{a}	12.47 ± 1.03 ^{a}	13.57 ± 1.29 ^{a}	13.40 ± 1.30 ^{a}
MCV (fL) 15-39	20.41 ± 0.83^{ab}	19.59 ± 1.22^{b}	21.16 ± 0.35^{ab}	22.70 ± 0.55 ^{a}	22.08 ± 0.30 ^{a}
MCH (pg)	7.27 ± 0.30 ^{bc}	7.00 ± 0.44^{c}	7.57 ± 0.13 ^{abc}	8.17 ± 0.22 ^{a}	8.00 ± 0.15 ^{ab}
MCHC (%) 32-40	35.58 ± 0.09 ^{a}	35.71 ± 0.95 ^{a}	35.75 ± 0.14 ^{a}	35.95 ± 0.23 ^{a}	36.23 ± 0.50 ^{a}
TWBC (/µL) 6800-20100	8133.33 ± 511.60^{bc}	9666.67 ± 707.42^{b}	7133.33 ± 899.51^{c}	12050.00 ± 569.65 ^{a}	13933.33 ± 590.86 ^{a}

Values are mean ± standard error of mean. Means on the same row with different superscripts are significantly different ($P<0.05$)

Table 1 shows the haematological values in WAD bucks before and after bloodless bilateral castration using Burdizzo method. Haematological changes observed include

a non-significant fall in PCV, Hb, and RBC upon castration, but there was a return to normal values of these parameters for the animals by the end of the study in week 4. Minimal fluctuations in MCV and MCH kept the MCHC within normal limits and there appeared to be no significant changes except for the total white blood cells, which rose, albeit not significantly (P>0.05), and later dropped, but then began to rise significantly (P<0.05), albeit all within normal range of values.

The results of serum protein levels of WAD bucks before and after bloodless bilateral castration with Burdizzo method are presented in Table 2.

Table 2. Serum protein levels of WAD bucks before and after bloodless bilateral castration using Burdizzo method

Parameter, normal values	Pre-castration Week 0	Post castration			
		Week 1	Week 2	Week 3	Week 4
Urea (mg/dL) 12.6-25.8	19.2 ± 2.56^{c}	52.8 ± 6.09^{ab}	54.3 ± 6.96^{ab}	30.5 ± 2.31^{a}	43.2 ± 5.00^{b}
Creatinine (mg/dL), 0.7-1.5	0.9 ± 0.07^{b}	1.6 ± 0.08^{a}	1.4 ± 0.09^{a}	1.4 ± 5.65^{a}	1.5 ± 0.10^{a}
Total protein (g/dL), 6.3-8.5	7.7 ± 0.35^{a}	6.1 ± 0.06^{b}	5.8 ± 0.07^{b}	5.7 ± 0.05^{b}	7.6 ± 0.24^{a}
Albumin 2.3-3.6	3.3 ± 0.07^{b}	2.9 ± 0.03^{bc}	2.8 ± 0.07^{c}	3.1 ± 0.04^{b}	4.9 ± 0.32^{a}
Globulin 2.7-4.4	4.4 ± 0.32^{a}	3.2 ± 0.04^{b}	3.1 ± 0.02^{bc}	2.6 ± 0.07^{c}	2.8 ± 0.04^{bc}

Values are mean ± standard error of mean. Means on the same row with different superscripts are significantly different (P<0.05)

Serum urea increased significantly (P<0.05) from pre-castration level to week 1, with a further rise in week 2, but it decreased non-significantly (P<0.05) in week 3 to a value higher than normal and increased again in week 4 to a level higher than the normal range in goats.

Creatinine only increased significantly (P<0.05) from within normal limits at pre-castration to week 1. Further changes in creatinine values were not significant (P>0.05).

The total protein was initially within normal limits, but decreased significantly (P>0.05) upon castration. This value remained so until the third week when it increased significantly (P<0.05) to within normal limits.

The albumin fraction was within normal range from pre-castration. It significantly decreased (P<0.05) in the first, second and third weeks post castration, but increased significantly (P<0.05) in the last week of the study.

The globulin fraction however was within normal range pre-castration and then decreased significantly (P<0.05). The decrease in globulin values continued until the end of the study.

Table 3 shows the serum enzymes of WAD bucks before and after bloodless bilateral castration using a Burdizzo castrator.

Table 3. Serum enzymes of WAD bucks before and after bloodless bilateral castration using Burdizzo method

Parameter, normal values)	Pre-castration Week 0	Post castration			
		Week1	Week 2	Week 3	Week 4
ALP (U/L) 61.3-283.3	158.2 ± 11.8^{a}	106.7 ± 8.43^{bc}	85.8 ± 5.70^{c}	166. 3 ± 31.9^{a}	154.7 ± 12.4^{a}
AST (U/L) 12-38	34.5 ± 2.86^{bc}	26.8 ± 3.54^{c}	32.3 ± 2.97^{b}	46.7 ± 4.01^{a}	38.7 ± 2.92^{ab}
ALT(U/L) 15.3-52.3	19.7 ± 1.43^{b}	19.3 ± 3.67^{b}	21.5 ± 3.00^{b}	32.8 ± 3.53^{a}	27.5 ± 3.84^{ab}

ALP - Alkaline phosphatase; AST - Aspartate aminotransferase; ALT - Alanine transaminase

ALP fluctuations were within the normal range of the values for goats, but within this range there were periods during which a significant decrease (P<0.05) occurred and an increase which began at the 3rd week.

The AST levels were within normal values at the beginning of the experiment, but decreased significantly (P<0.05). They later increased significantly (P<0.05) by week 2, and this was followed with a further increase at week 3, which was not significant (P>0.05).

Serum ALT remained within normal limits throughout the period under study, but showed a significant difference (P<0.05) in value from pre castration levels to week 3, with a further decrease in week 4, which was not significant.

Discussion

The increase in TWBC values is in agreement with the results obtained by MURATA (1997), FISHER et al. (1997) and MOHAMMAD et al. (2008) who observed an increase total white blood cell values in surgically castrated calves and Burdizzo castrated calves which later returned to normal values seven days after castration. This may be due to reactive leucocytosis and stress associated with the procedure.

The effects of surgical castration on serum enzymes and plasma proteins have been studied (ROBERTSON et al., 1994; OYEYEMI et al., 2000; MOHAMMAD et al., 2008). The results of this study appeared similar to those reported by the authors mentioned above.

The changes in urea are similar to the increase in values reported by MOHAMMAD et al. (2008). This is consistent with urea changes in goats, in which urea functions as a source of nitrogen for protein biosynthesis and in which the excessive breakdown of protein leads to the formation of ammonia from urea from the digestive tract or plasma (HARMEYER and MARTENS, 1980). This is because inflammatory and necrotic changes occurring in the testes lead to the breakdown of tissues, as observed by OYEYEMI et al. (2000), which leads to a significant increase in urea values.

The change in creatinine observed in this study agrees with what was reported in Awassi lambs which underwent surgical castration (MOHAMMAD et al., 2008).

The changes in ALP differs from the report by OYEYEMI et al. (2000), in which significant increases outside the normal range occurred in the first 4 weeks following surgical castration in WAD goats, but agrees with findings of changes in Awassi lambs, which were also surgically castrated.

The changes in urea, creatinine and ALP are likely due to increased catabolic breakdown of tissues resulting from the castration (MOHAMMAD et al., 2008).

A major finding in this study is that the changes in serum enzymes approximated normal values in the third week after castration, which may be indicative of the period in which inflammatory changes subside and healing may be expected, if surgical castration has been performed.

PANG et al. (2006), when studying acute phase proteins following several methods of castration, found that Burdizzo castration elicited the least reaction in Holstein cattle and this is in agreement with what was observed in this study. The mild changes in values observed in this study were similar to the observations reported in surgically castrated WAD goats by OYEYEMI et al. (2000).

The non-significant hypoproteinemia observed immediately after castration which persisted for 2 weeks is in agreement with observations by OYEYEMI et al. (2000), but contrary to observations made with Awassi lambs (MOHAMMAD et al., 2008). This may be related to the immune status of the animal as well as a reduction in acute phase proteins, which are indicative of pain related stress in biological systems as reported by MOLONY et al. (1995).

It is safe to conclude that castration of WAD goats may be safely carried out by Burdizzo method and that the effects on serum enzymes and proteins are minimal.

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SAŽETAK

Tijekom četiri tjedna promatrani su učinci beskrvne obostrane kastracije Burdizzo kliještima u šest jaraca zapadnoafričke patuljaste pasmine, uzgajanih na obrazovno-istraživačkoj farmi Sveučilišta Ibadan u Nigeriji. Razina ureje značajno je porasla ($P<0,05$) od prvog do trećeg tjedna kada se značajno smanjila ($P<0,05$) da bi ponovno porasla u završnom tjednu istraživanja. Razina kreatinina također je značajno ($P<0,05$) porasla, bez daljnjih promjena do četvrtoga tjedna istraživanja. Razina alkalne fosfataze bila je značajno snižena ($P<0,05$) od prvoga do trećega tjedna promatranja, a nakon toga njezina je razina bila značajno povišena. Razina alanin transferaze nije se značajno mijenjala sve do trećega tjedna kada je porasla ($P<0,05$), a nakon toga opadala tijekom posljednjega tjedna istraživanja. No, bez obzira na opadanje, njezina razina bila još uvijek viša u odnosu na onu prije kastracije. Razina bjelančevina u serumu rasla je i opadala bez statistički značajnih razlika, ali je kasnije značajno porasla ($P<0,05$) u odnosu na razinu prije kastracije. Iako su se frakcije albumina postojano smanjivale do trećega tjedna, to nije bilo statistički značajno, već je značajan porast ($P<0,05$) bio opažen u posljednjem tjednu istraživanja. Razina globulina značajno se snizila i ostala jednaka sve do kraja istraživanja. Vrijednosti pokazatelja u krvi nisu pokazale značajan porast PCV, Hb, RBC kao ni ostalih pokazatelja osim broja leukocita koji se značajno povećao ($P<0,05$) nakon kastracije i ostao povišen do četvrtoga tjedna kada se vratio u granice normale. Istraživanje je pokazalo da beskrvna kastracija ima slabiji učinak na promjene u serumu i može biti sigurnija zamjena za kirurško kastraciju zapadnoafričkih patuljastih jaraca, posebice ako postoji manjak proteina ili jetrena insuficijencija.

Ključne riječi: hematološki i biokemijski pokazatelji, kastracija, zapadnoafrički patuljasti jarac, Burdizzo kliješta