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Original article

BILATERAL ORCHIDECTOMY IN WEST AFRICAN DWARF (WAD) GOATS: EFFECT ON BLOOD ELECTROLYTE LEVELS

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SUMMARY

Seven 8 – 12 months old WAD bucks were surgically bilaterally orchidectomised. Blood samples were collected each buck punture 3 days prior to surgery and subsequently at weekly intervals for 7 weeks post surgery. Accruing serum from the blood samples was analysed for electrolytes including Na^+, K^+, Ca^{++}, HCO_3, Cl and PO_4^{2-}. Statistically significant differences were observed in the mean values of K^+ Ca^{++} and Cl ($P < 0.05$) from pre orchidectomy values. Variations in the mean values of the other electrolytes were not significant. It was concluded that the serum electrolyte profiles of orchidectomised WAD bucks should always be taken cognisance of when using such animals for experiments or other projects.

RESUME

8 - 12 Mois de WAD buffles ont ete bilateralement operes pour . Des echantillons de sang ont ete collectes par buffle par piqure trois (3) Jours avant L'operation et suivit chaque semaine pendant spt (7) semaines apres L' operation. Le serum de ces hantillons de sang a ete analyse pour sa contenue en ions; Na^+ K^+, Ca^{2+}, Hco_3, cl et Po_4^{2-}. Des differences statistiquement significante ont ete observees en valeur moyenne du k+, Ca^{2+}, et cl (p 0.05) comparees aux valeurs avant l'operation. Les variations en valeurs des autres ions n'etaient pas significantes. C'etait conclu que le profil des ions dans le serum devrait toujours etre prise en consideration utilisant tels animals en experience pratique et d'autres projets.

INTRODUCTION

Orchidectomy is practised in livestock farming for a variety of reasons including genetic selection, case of handling and accelerated weight gain (MCDOwell, 1972). Castrated animals can also be used as teasers to detect estrus. The need and potential for livestock improvement in Subsanhara Africa has long been recognised (IICA, 1980; Williamson and Payne, 1984; Okali and Upton 1985). In the subhumid zones of West Africa efforts are now in top gear to upgrade the indigenous livestock including the West African Dwarf small ruminants. The Dwarf goat is characteristically hardly and adapted to the hot and humid conditions of the West African Coastal regions. Such genetic endowments are being upgraded with those of larger breeds from the drier northern parts (Akinwole, *et al* 1998).

Upgrading processes often entail discouragement of breeding by bucks with undesirable characteristics. This is where the practice of orchidectomy might become important in the keeping of WAD goats. It was therefore thought necessary to establish the effect of orchidectomy on the bucks since orchidectomised animals may be needed for used for other research projects.

MATERIALS AND METHODS

Animals preparation and Surgical procedure

Seven 8 –18 months old WAD bucks were used for the experiment. They were purchased from a local goat market. They were clinically healthy animals and were dewormed with Banminth® (pfzer Nigeria brand of Morantel tartarate) and Cydectin® (Ivomecine – Bayer Germany). They were housed in the small Ruminant unit of the Teaching and Research Farm, University of Ibadan. They were kept indoors at night but were allowed to graze and browse in the fenced paddocks during the day. This outdoor feeding was supplemented every evening with a concentrate ration containing 12% crude protein. The goats had unlimited access to drinking water 3 days before orchidectomy 10ml blood was collected from each animal through the jugular vein. This sample served as the control or reference sample. Following surgery, additional 10ml blood was taken from each buck on weekly basis for the next 7 weeks.

The open method of orchidectomy was adopted for the study. Each buck was restrained in dorsal recumbency on a surgical table. The scrotal area was disinfected by swabbing with methylated spirit 5ml of 2% lignocaine hydrochloride solution was then pumped directly into the substance of each testicle through the tensed scrotal skin. The skin itself was desensitised by a local subcutaneous infiltration around the neck of the scrotum (Hall, 1979).

Table 1
Serum Electrolyte Profile of Bilaterally Orchidectomy West African Dwar Goat
Means ± SEM with different superscript on the same row are significantly different. P as shown.

Parameter	Pre-orchidectomy	Weeks Post-orchidectomy							
		1	2	3	4	5	6	7	P value
Sodium (mmol.l)	142.00 ± 1.34$_a$	141.14 ± 1.34^a	139.43 ± 1.72^a	139.0 ± 2.14^a	139.1 ± 2.15^a	123.1 ± 20.5^a	144.4 ± 0.43+	143.7 ± 0.42^a	n.a
Potassium (mmol/l)	5.05 ± 0.30^{bcd}	5.71 ± 0.05^{ab}	5.34 ± 0.22^{abc}	6.10 ± 0.21^a	6.21 ± 0.23^a	4.24 ±0.71^d	4.69 ± 10^{ds}	4.72 ± 0.75^{de}	0.0001
Calcium (mmol/l)	8.50 ± 0.04^{bc}	7.11 ± 0.21^c	10.43± 0.21^b	8.93 ± 0.15^b	7.50 ± 1.25^b	7.50 ± .25^{bc}	9.43 ± 4.52^{bc}	8.70 ± 0.03^b	0.0009
Chloride (mmol/l)	4.98 ± 0.4^a	5.90 ± 0.18	5.89 ± 0.38^a	6.17 ± 0.17^a	4.00 ±0.60^b	5.37 ± 0.92^a	5.49 ± 0.11^a	6.00 ± 0.12^a	0.0001
Bicarbonate (mmol/l)	23.50 ± 0.65^a	22.14 ± 0.14	23.43 ± 0.65^a	22.43 ± 0.61^a	22.71 ± 0.81^a	19.57 ± 3.32^a	23.14 ± 0.40^a	22.57 ± 0.53^a	n.a
Phosphate (mmol/l)	106.00 ± 0.41^a	103.00 ± 0.38	102. 29 ± 0.57^a	105.1 ± 0.92^a	104.7 ± 0.9^a	91.14 ± 0.94^a	106.2 ± 0.52^a	106.3 ± 0.36^a	n.a

Each testicle was tehn held tightly and a single incision was made along the stretched scrotal skin to open up the scrotum. The incision. on the average 3-5cm long, penetrated the tunica vaginelis which then retrated and allowed the testicle to pop up. Its attachment to the scrotal wall via the gubernaculum at the caudal epididymal end was severed together with the spermatic cord. A three-pronged ligature and clamping technique was employed to ensure haemostasis. With the testicle removed a single stitch with a six 1.0 chromic catgut was employed to close the wound. The same procedure was repeated for the other testicle 1.0ml of combitic containing penicillin (70%) and streptomycin (30%) was then administered parentally while 0.5ml of it was infused into the scrotum, which was then massaged gently to aid perfusion. Also 1ml of analigin (Shanghai Medical Coy, China was administered as analgesic (Bojrab 1990). Further post operation care consisted of a further antibiotic cover with Penstrep (1.5ml in X 4 days), clean resorption and drainage.

Laboratory Analysis of blood samples

Sodium and potassium ions were determined with a flame photometer (Corning Model 400, Corning Scientific Limited, England). Serum calcium level was measured by the cresolphatalein complesone technique (Toro and Ackermann, 1975). Briefly, calcium in alkaline environment was allowed to form a complex with cresolphtalein complexone. The purple coloured complex, which is proportional to calcium concentration in the serum, was measured at 525mm. The serum phosphate concentration was measured as described by Gomori (1942). Trichloroacetic (TCA) was used to precipitate the proteins in test sera before analysis. The phosphate containing filtrate obtained after the TCA precipitation was reacted with molybdate to form a phosphomolybdate complex which was then reduced with p-methylaminophenol, rsulting in a molybdenumn# blue complex measurable spectrophotometrically at 650mm. Serum bicarbonate (HCO_3.) was measured by he titrimetric method utilizing sulphuric acid ad sodium bnudroxide standard solutions and methyl red as the end product indicator (Toro and Ackermann, 1975).

The serum chloride was determined as described by Schales and Schales (1941). Briefly, chloride is titrated with mercuric soluble leading to the formation of water-soluble mercuric chloride, which is only slightly dissociated. The free Hg^{2+} appearing at the end point forms a violet-blue complex with the diphenylcarbazone indicator. This is then measured spectrophotometrically.

RESULTS

Table 1 shows the mean values obtained for the electrolytes assayed. There were significant differences in the pre and post orchidectomy mean value in K^+ ($P < 0.0001$) and Ca^{2+} ($P < 0.0009$) and Cl^- ($P < 0.0001$). Variations ion the values for the other ions were not significant. The level of Na^+ decreased slightly immediately after orchidectomy reaching the lowest level (as did all the ions, excepting K^+) in the 5th week. Thereafter it rose again and by the 7th week had returned to the pre-operation level.

The decrease in Na^+ level following orchidectomy was countered by a rise in the level of K^+. This peaked in the 4th week and witnessed a steady decline as from the 5th week. Similar trends marked the changes in the mean values of the other ions. A common feature was that almost all of them had their lowest values in the 5th week.

DISCUSSION

Electrolytes play a central role in the maintenance of the homestatis of the internal environment that is, extracellular fluid. In addition, they are associated with the transmission of nerve imupulses, muscle contraction and enzymatic reactions (Swenson 1981). They also play a role in carbon dioxide transport, inter compartmental water balance and critical cell functioning (Raffe, 1987). In this study significant increases were observed in the mean serum values of K^+, Ca^{2+} and Cl^- and there were also increases in the mean values of the other electrolytes assayed which were not statistically significant.

Sodium is the main cation of extracellular fluid (CF) while potassium occurs mainly in the intra cellular fluid (ICF) compartment. The anion Cl^- is found also in the ECF but more so in erythrocytes. Alterations in the values of these ions will not only affect the fluid distribution between the ECF and the ICF but also the values of other electrolytes and thus osmoic pressure of the fluids. (shoemaker 1984; Coldberg, 1981; Feig, 1981). The appreciation and management of these phenomena are very critical for a successful outcome of surgical procedures (Raffe, 1987).

The lack of significant in the mean value of Na^+ observed in this study would suggest that the bilateral orchidectomy had little if any effect on the ECF volume in WAD bucks. But this could be misleading because the operation occasioned trauma and subsequent oedema of the scrotal tissue. This would precipitate some form of fluid redistribution between the ECF and ICF. That probably occurred and would account for the observed decreases in mean value of Na^+ immediately following the orchidectomy up until the 5th week when the lesion had considerably resolved.

The hyperkalaemia observed in this study probably resulted from a massive leakage of K^+ from damaged and necrotic cells into the ECF. Most of the cells in the area of the wound were initially oedematous and K^+ could easily likely result in some imbalance in the fluid distribution between the ICF and the ECF. It is noteworthy however that the mean value of K^+ in the serum decreased as from the 5th week when the oedema had resolved and wound healing had became advanced. The significant increase in the mean value of Cl^- could have resulted from a decreased urinary excretion of the ion (in conjuction with Na^+) or some Cl^- could have leaked out from the erythrocytes. Whichever was the case the increase could probably have served to ensure electrical neutrality in the body fluids.

There was little change in the mean value of the bicarbonate anion (HCO_3) throughout the duration of the study. HCO_3 is mainly there in the body fluid to counteract (H^+) and provide acid-base balance. The lack of appreciable change in mean value would suggest that bilateral orchidectomy in WAD bucks did not affect the acid-base balance of their body fluids.

Calcium and phosphorus are usually related in their metabolism. Their occurrence in skeletal tissues (of which they form the bulk) is usually in dynamic equilibrium with their values in body fluids and other tissues (Coles, 1974; Swenson, 1981). The androgen testosterone has been credited with encouraging the retention of calcium and its accretion in bone matrix (Cooke and Sharpe, 1988). Orchidectomy removed a main source of testosterone in the body. As this deficiency could not possibly be compensated for by any denave biosyntheis, dietary calcium would therefore linger longer than usual in the blood stream. Also the scrotum is a highly sensitive area and a lot of nerve twigs would have been severed during orchidectomy. The resulting disturbance in impulse transmission could increase serum calcium levels since the cation is involved in impulse transmission (Shoemaker, 1984; Goodman and Gilman 1991; Adams, 1988). Phosphorus is not only found in the bones but also in cellular protoplasm (Shoemaker 1984; Chew *et al*. 1982). In the form of phosphate, phosphorus partakes in the formation of Adenosine Triphosphate (ATP) an important means of cellular energy transfer. (Gross, 1988). Available phosphorus could have been readily snapped up in the formation of ATP since a lot of this activity was going on during the process of wound repair (Chew *et al* 1982).

Ogunsanmi *et al* (1994) assayed the serum minerals in West African Dwarf sheep infected with Trypanosoma brucei. They observed a significant decrease in calcium level and increase in inorganic phosphate and bicarbonate levels. These are variance with our findings in this study. However, our observation on the increased level of

chloride ion in the blood tallied with their results. More minerals levels in the sera of West Africa Dwarf goats sedated with zylazine. They obtained lower calcium but higher inorganic phosphate values than we did in this study.

One noteworthy observation here was the fact that most of the minerals assayed had their fact lowest values in the 5th week post orchidectomy. The reason for this phenomenon is not know but may be worth elucidating. We suspect that it might have had to do with the stage of the wound healing (by this time it had mostly healed) than with anything else.

In conclusion it is advised on the basis of the findings of this study that livestock formers and veterinary practitioners be cautions in their use of orchidectomised bucks especially in the first 6-7 weeks after such operation.

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