

Original article

## THE EFFECTS OF BILATERAL ORCHIDECTOMY ON SOME SERUM ENZYMES AND PROTEINS IN THE WEST AFRICAN DWARF BUCK

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### SUMMARY

The effects of bilateral orchidectomy on serum protein and enzyme levels were investigated in 12 healthy West African Dwarf bucks over a 7-week period. Although the activity of alkaline phosphatase increased over the period, the increases were not statistically significant. There was a significant drop ( $p < 0.05$ ) in the activity of Aspartate amino transferase in the last 2 weeks of the study while alanine transaminase (ALAT) and gamma glutamyl transferase (GGT) showed variation, which were in some cases significant. There was a slight hypoproteinaemia, which was traceable mainly to the globulin fraction. In fact in the 2<sup>nd</sup> -4<sup>th</sup> post-treatment week the albumin/globulin ratio (AGR) was inverted. The implication of these finding for the functional status of the castrates are discussed.

*Keywords:* Bilateral orchidectomy, serum, enzymes, goat

### RESUME

*Des recherches ont été menées pour identifier les effets de la castration bilatérale sur le sérum protéinique et des niveaux d'enzymes de douze (12) canards nain et saints d'Afrique de l'ouest sur une période de sept (7) semaines. Bien que l'augmentation de l'activité de l'alkaline phosphatase durant cette période, ces augmentations n'étaient pas statistiquement significatives. Il y avait une baisse significative ( $P < 0.05$ ) de l'activité de l'aspartate amino- transférase pendant les deux (2) dernières semaines de l'étude, pendant l'alanine transaminase (ALT) et gamma glutamyle transférase (GGT) ont montré des variations qui étaient significatives dans certains cas. Il y a eu une légère hypoprotéinémie qui était détectable seulement dans la portion globulaire. En fait à la quatrième semaine d'après traitement la fraction albumine/globuline a été inversée. L'implication de ces données pour le statut fonctionnel des canards castrés ont été discutées.*

The domestic goat belongs to the genus *Capra capra* and it must have descended from the species *Capra oegrapus* from which new varieties of breeds evolved bearing physical characters molded by the environment in which they found themselves (Williamson and Payne, 1984).

The male reproductive system comprises the testis, epididymis and accessory organs. The testes produce the spermatozoa and the male sex hormone- testosterone. The testes vary somewhat from species to species as far as shape, size and location are concerned but the essential structure is the same (Frandsen, 1981).

Orchidectomy is a technical term given to the surgical removal of the testes of the male although it can also apply to spaying or removal of the ovaries of female as well (Frandsen, 1981; Mackenzie, 1980). Orchidectomy is usually practiced to prevent animals with inferior bloodline from reproducing. This is important in improving all breeds of animals. Early orchidectomy effectively improves the quality of individual animals used for food by inhibiting undesirable secondary sex characteristics (Setchell, 1972; Mackenzie, 1980).

In a series of studies conducted recently to evaluate the importance of bilateral orchidectomy as a tool for improved small ruminant production in the hot humid tropical sub region it was decided to include the assessment of some aspect of the serum enzyme and plasma biochemistry of the orchidectomised bucks as this could give indication of any damage to host tissues particularly the liver (Sevelius, 1995). This report documents the outcome of this investigation aimed at elucidating the responses of some serum enzyme and lipids to bilateral orchidectomy of the West African Dwarf buck using the open method.

### MATERIALS AND METHODS

#### *The Experimental Animals*

Twelve healthy West African Dwarf goat bucks aged between 18-24 months and 12-15kg were used after ascertaining that they were free of obvious physical, clinical andrological abnormalities.

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### Management of the Experimental Animals

The bucks were housed in roofed and well-ventilated pen. They were kept indoor at night (1800-0700hr) and released for grazing on grass and legumes during the day (0700-1800hrs). The type of grasses they grazed upon included carpet grass (*Axonopus compressus*), guinea grass (*Panicum maximum*), elephant grass (*Pennisetum purpureum*). They were also fed with dry cassava peelings (*Manihot esculata*). Fresh water was available *ad libitum*.

The bucks were dewormed with Morantel citrate monohydrate (Banmith® Pfizer, Nigeria) at a dosed rate of 2ml/3kg-body weight. Ivermectin (Rhone Merieux, Lyon, France) was also given at a dosed rate of 1ml/50kg body weight. The animals were collected by jugular venepuncture from each animal before and weekly for the next seven weeks after bilateral orchidectomy. The orchidectomy itself was performed by the open method as previously described by Olaifa *et al* (1999). The blood samples were put into tubes containing lithium heparin anti coagulant and centrifuged immediately after collection. The resulting plasma were stored at -25°C until analyzed which was usually within 24hr of collection.

### Sera Analysis

The concentration of alanine transaminase (ALAT) and aspartate transaminase (ASAT) in the resulting sera were determined by the use of commercial kits based on the method of Henry *et. Al.* (1960). The alkaline phosphatase (ALP) level was determined electrophotometrically using P-nitrophenol as substrate. Gamma glutamyl transferase (GGT) level was determined by the method of Szas (1969). The concentration of fibrinogen was determined by the refractometry method (Coles 1989), using the Goldbery refractometer no 10,400 (American Optical Company, Buffalo, New York). Serum total protein albumin levels were determined respectively by the Biuret method (Reinhold, 1953) and the bromocresol green method (Doumas *et.al.* 1971). The globulin concentration (GLB) was estimated by subtracting the albumin from the total protein (TPP) VALUE (Coles. 1989).

### Statistical Analysis

The resulting data were pooled together for means per week and the means were subjected to student paired "t" test (Snedecor and Cochran, 1980) and observed significant differences were further subjected to Duncan's multiple range test (Duncan, 1989) for means separation and interpretation.

## RESULTS

The results obtained are shown on Table 1. Although there were relative differences in the weekly mean values for alkaline phosphatase (ALP), these were not statistically significant. The highest mean value occurred in the 4<sup>th</sup> week post-orchidectomy while the least was in the 5<sup>th</sup> week. All the post-orchidectomy values were higher than the pre-orchidectomy value. The mean values for aspartate aminotransferase (AST) activities in weeks 2,3,4 and 5 were neither significantly different from one another nor from the pre-orchidectomy value. However, the mean values for the 6<sup>th</sup> and 7<sup>th</sup> post-orchidectomy weeks statistically lower than them ( $p < 0.05$ ). The mean value for 1<sup>st</sup> post-orchidectomy week was statistically lower than them ( $p < 0.05$ ). The mean value for 1<sup>st</sup> post-orchidectomy week was statistically higher than the others including that of the pre-orchidectomy or control ( $p < 0.05$ ).

**Table 1**

Variables		Pre-				Post-Bilateral Orchidectomy		
		Week 1	Week2	Week3	Week4	Week5	Week6	Week7
Alp (alkaline Phosphatase)I U/L	103.25 ± 20.75 <sup>a</sup>	300.86 ± 136.59 <sup>a</sup>	508.43 ± 236.45 <sup>a</sup>	618.86 ± 265.22 <sup>a</sup>	644.71 ± 282.03 <sup>a</sup>	235.57 ± 68.06 <sup>a</sup>	285.43 ± 63.26 <sup>a</sup>	275.71 ± 37.79 <sup>a</sup>
Glutamic oxaloacetic acid Transferase IU/L	142.50 ± 33.52 <sup>ab</sup>	169.71 ± 34.13 <sup>a</sup>	104.86 ± 9.02 <sup>ab</sup>	123.43 ± 7.68 <sup>ab</sup>	112.43 ± 13.46 <sup>ab</sup>	117.57 ± 13.46 <sup>ab</sup>	44.57 ± 10.79 <sup>c</sup>	77.57 ± 13.25 <sup>ab</sup>
Alanine transaminase (ALAT) IU/L	19.75 ± 2.02 <sup>bc</sup>	16.86 ± 2.81 <sup>bc</sup>	16.29 ± 3.70 <sup>bc</sup>	15.00 ± 2.1 <sup>bc</sup>	12.71 ± 1.13 <sup>c</sup>	14.		

The mean alanine aminotransferase (ALAT) activity values for weeks 6 and 7 were significantly higher ( $p < 0.05$ ) than the control the mean valued for the other weeks did not differ significantly from one another or the control. With respect to gamma glutamyl transferase (GGT) the mean values for post-orchidectomy weeks 1,2,3,4&5 differed significantly from those of the other weeks including the control ( $p < 0.05$ ).

The mean values for total plasma protein (TPP) for the 1<sup>st</sup>, 4<sup>th</sup> & 6<sup>th</sup> weeks post-orchidectomy were significantly different from the others including the pre-orchidectomy value. The highest mean value ( $3.76 \pm 0.18$ ) was recorded in the 4<sup>th</sup> post-orchidectomy week. The data for globulin (GLB) showed that the values for weeks 2,3,4&5 post-orchidectomy were significantly lower ( $p < 0.05$ ) than the others including the control. The pre-orchidectomy value was in fact, higher than the overall mean post-orchidectomy value ( $p < 0.05$ ) A similar degree of fluctuation attended the distribution of the albumin/globulin ratio which was actually inverted in the 2<sup>nd</sup> 3<sup>rd</sup> & 4<sup>th</sup> post-orchidectomy weeks.

## DISCUSSION

Serum, both human and animal, has been showed to contain atimes enzymes, which serve no obvious functions there and are presumably derived either by leakage from living cells or from the debris of dead or dying cells. Several diseases are accompanied by marked changes in the level of certain enzymes in the serum. All the enzymes investigated in this study belong to the class whose level in the blood can be used diagnostically to determine the level of damage or dysfunction of one tissue or another but especially the liver kidney and the heart (Bell et. Al., 1972; Sevelius, 1995). But unlike the human serum where normal ranges of these enzymes have been established the normal ranges of enzymes in the sera of most species of animals have not been determined. For each study therefore the level before the administration of experimental treatment must necessarily represent the normal or control if the subjects are clinically healthy. Such was the case in this study.

The level of AST (also known as Glutamate-oxaloacetate transaminase [GOT] rose rather sharply in the first orchidectomy week and declined thereafter to well below the control level by the end of the study in the seventh week. Although AST is not specific to any particular organ in the body (Coles, 1989) it is the most important of the transaminases that catalyze the reaction between glutamic acid and its keto acid- $\alpha$ -oxoglutaric acid. It catalyses the reaction between glutaric and oxoglutaric acid. The activity of AST in the blood serum in man (SGOT) has been known to increase in the first few days after a coronary thrombosis because the enzyme is release from damaged cells in the myocardium. This rise can be as much as 5-fold if there is much tissue damage (Bell et al, 1972). Wilkinson (1982) also observed this initial rise in AST activity in the serum of orchidectomised bucks. It was observed that the AST level would return to normal as the wound healed.

The initial increase in the serum level of AST observed in this study would therefore be due to leakage from dead or damage cells of the scrotum. The level has fallen even below the value by the seventh week when the wound had substantially healed. Alkaline phosphatase (ALP) is a widely distributed enzyme whose levels in human serum has been for diagnosis of liver and bone diseases (Bell et al, 1972). Although the increase of ALP activity in caprine serum following orchidectomy was not statistically significant it was scientifically relevant in that it indicated the hightened level of metabolic activity-breaking down and replacement of dead or damage tissue that was in progress. ALP activity did not return to the pre-orchidectomy level by the seventh week-suggesting the possible involvement of other organ such as the liver as hypothesized by Coles (1989) and Malherbe, (1960).

The mean values of gamma-glutamyl transferase (GGT) shows some consistency though there were significant variations in weeks 2-5 post orchidectomy. Such consistency and increase in the value of GGT had been suggested by Cole, (1989) and Hoe, (1961) to be due to the stress or orchidectomy and liver cell damage. The significant increase of weeks 3 and 4 and the return to normal levels towards the end of the study agree with the finding of Wroblewski and Ladue, (1955) and Wilkinson, (1982) that elevated serum glutamate glutamyl level was likely to result from a suspected hepatitis causing mild cholestasis. Also Cornelius (1979) had reported that serum level of GGT may return to normal 6 weeks after castration. The activity of alanine transaminase in the serum fell soon after castration. This was then followed by an increase in the last weeks, which was actually significantly higher than the control. Pearson and Craig, (1980) attributed such reaction to severe liver damage.

There was a net hypoproteinaemia, which was traceable to a significant drop in the level of the globulin fraction from the 2<sup>nd</sup> to the 4<sup>th</sup> week post-orchidectomy. In fact during this period the albumin/globulin ratio (AGR) was inverted. The reason for this is not clear but it does indicate a lowering of the immune status of the castrate at this time. Globulins are produced normally by the liver so any decrease in serum globulin level result from the liver's inability to quickly meet any loses that would attend increased protein catabolism as a result of tissue (scrotal) damage (Kaneko, 1989). The slight overall hypoalbuminaemia could also have resulted from hepatic dysfunction as a result of tissue damage and hepatic response to tissue reaction and blood loose. It certainly would after the osmolality of the serum but this was not investigated.

In conclusion, bilateral orchidectomy resulted in increase level of some diagnostically important enzymes in the serum of West African Dwarf bucks. It also resulted in lowered serum protein levels especially of the globulin fraction. The implication of this for the immune competence for the castrates would therefore seem to call for further investigation. This, the authors plan to do as soon as possible.

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