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# Effects of Xylazine and Propofol Treatments on Some Semen and Serum Biochemical Parameters of the Red Sokoto Buck

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## ABSTRACT

The effects of xylazine and propofol on semen parameters, serum testosterone and follicle stimulating hormone levels of the red Sokoto buck were investigated. Twenty seven red Sokoto bucks, at the age of 2 years and weighing between 32 and 34 kg were used. Following an intramuscular administration of 0.22 mg/kg of 20 mg/ml of xylazine and an intravenous injection of 10 mg/ml of propofol at 6 mg/kg, semen and sera samples were collected at 1, 24, 72, and 192 hours post administration for analysis. The parameters studied were volume of semen, percentage motility, sperm concentration, semen glucose, serum testosterone and follicle stimulating hormone. These parameters were found to decrease significantly ($p<0.05$) when compared with the pretreatment group throughout the collection period. However, the drugs did not affect the live sperm percentage. These findings indicate that xylazine and propofol decrease semen volume, sperm concentration, semen glucose, serum testosterone and follicle stimulating hormone. It was concluded that both drugs should be used cautiously in red Sokoto bucks meant for breeding due to the deleterious effects they may cause on fertility parameters.

**Key words:** Xylazine, propofol, red Sokoto buck, semen, serum

## INTRODUCTION

Goats are among important livestock specie which serve as a source of meat, milk, skin and wool (Guss, 1977). It has been estimated that there are about 34.5 million goats in Nigeria whose population ranks as the second most important livestock specie (Adu *et al.*, 1979). Three main varieties of goats common in Nigeria are the Sahel, the red Sokoto and the West African Dwarf Goats (Aliyu, 1990).

Research findings have shown that drugs have considerable effects on the male reproductive system of domestic animals and man. The bark of *Corynanthe yohimbe* (*Yohim-be*) and *Pausinystalia johimbe* (*Rubiaceae*), are used to improve fertility, body building and performance in humans, and in captive breeding program of wild animals (Abdulhakeem *et al.*, 2006). Kuncheva *et al.,* (1981) reported that, toxicity of yohimbe causes stimulation of the mitotic activity of spermatogonia in mature male rats and increases sperm cell counts while Smith *et al.,* (1987) reported that yohimbine increased the rate of copulation and reduces the intercopulatory interval in rats. When administered in dogs, yohimbe increased the spermatozoal output and prevented the decrease in volume of semen ejaculated (Yonezewa *et al.,* 1991). Significant improvement in semen volume, sperm density, and sperm motility was noticed in men treated with Clomiphene citrate (Micic and Doltic, 1985).

The daily spermatozoal output (DSO) is consistently lower than the daily spermatozoal production (DSP) (Olar *et al*., 1983). Several factors, including spermatozoal losses in the collection equipment (Amann, 1970; Amann *et al.*, 1974), phagocytosis and epididymal absorption of spermatozoa (Amann *et al.,* 1974; Bedford, 1976), or overestimation of DSP (Amann, 1970; Amann, 1981) which have been studied, failed to account for the quantitative differences between DSO and DSP.

In veterinary practice, several other drugs both are administered to animals to treat infectious diseases and/or to achieve predetermined physiological modifications such as anesthesia or smooth muscle contraction amongst others (Benson, 2000 and Abdulhakeem *et al.,* 2006).

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Xylazine, a potent alpha$_2$-adrenergic agonist structurally related to clonidine is classified and used as a sedative/analgesic with muscle relaxant properties. Xylazine can induce increases in blood glucose secondary to decreased serum levels of insulin (Shokry *et al.,* 1976). In non-diabetic animals, there appears to be little clinical significance associated with this effect. Ruminants are extremely sensitive to xylazine and in cattle polyuria is seen following xylazine administration, probably as a result of decreased production of vasopressin. Bradycardia and hypersalivation are also seen in cattle and are diminished by pretreating with atropine (Thurmon *et al.,* 1977).

Propofol, 2,6-disopropylphenol, one of the newer general anesthetic drug is essentially insoluble in aqueous solutions and is formulated only for intravenous administration as a 1% (10 mg/ml) emulsions, 10% soybean oil, 2.25% glycerol and 1.2% purified egg phospholipid (Bennett *et al*., 1995). It is often used for maintenance of anesthesia as well as induction.

These drugs may have beneficial or deleterious effects on the fertility of the animals they are used on. The aim of this research therefore is to investigate the effects of xylazine and propofol on some semen and serum biochemical parameters of the red Sokoto buck and thus evaluating their effects on the fertility of this important breed of goat.

## MATERIALS AND METHODS

### *Experimental animals*

Twenty seven adult red Sokoto bucks, at the age of 2 - 2.5 years and weighing between 32 and 34 kg, were selected at random for this study on the basis of their soundness for breeding purposes (Roberts, 1971). During the study, bucks were housed in brick pen houses with concrete floors at the large animal unit of the Usmanu Danfodiyo University Veterinary Teaching Hospital (UDUVTH), Sokoto, in two groups of fourteen and thirteen bucks per group. They were fed with wheat bran and bean husks twice daily, allowed some level of free grazing and tap water provided *ad libitum*.

### *Administration of test drugs*

The treatment groups comprised xylazine or propofol treated buck. The xylazine treated group received an intramuscular injection of 20 mg/ml of xylazine hydrochloride (Indian Immunologicals Ltd., Gollapadu Guntur) at a dose of 0.22 mg/kg while the propofol treated group received an intravenous injection of a solution of 10 mg/ml of propofol (Claris Life Sciences Ltd., India) at a dose of 6 mg/kg.

### *Sample collection and analysis*

Bucks were randomly assigned to one of two groups comprising of xylazine treated and propofol treated groups. Semen and sera samples were collected before (pretreatment) and after treatment with xylazine and propofol at 1, 24, 72 and 192 hours. To obtain semen samples, bucks were restrained in a standing position and semen was collected from bucks by the method of electro ejaculation as described by Baracaldo *et al*. (2006). Immediately following collection of semen, evaluation for percentage motility of sperm was carried out. This was determined by the progressive and non-progressive movement of sperm observed under a compound microscope (Laborlux II, Leitz Germany) as described by Anderson *et al.* (1983) and VijayKumar *et al.* (2004). The sperm count was determined under a Neubauer haemocytometer (Superior, Marienfeld, Germany) as described by Al-Shabanah, (1997). To evaluate for the dead and live sperm percentage the sperm suspension was stained with eosin negrosin; smears were made on slides, air dried and examined microscopically as described by Al-Shabanah, (1997) and Anderson *et al.* (1983).

Blood samples collected by jugular venipuncture were centrifuged at 3000rpm for 15 minutes and sera harvested for assessment of testosterone and follicle stimulating hormone concentration by radioimmunoassay using a testosterone and follicle-stimulating hormone EIA test kits respectively (Clinotech® Diagnostics and Pharmaceuticals Inc., Canada). The determination of the semen glucose level was done by the glucose oxidase method which employed the use of a digital photocolorimeter as ued by Cheesebrough (2004) according to Randox® manufacturer's instructions.

### Statistical analysis

Statistical analysis of the data obtained before and after the drugs treatment was performed using paired Student's *t*-test. All results are expressed as means ± standard deviation. Results were considered statistically significant at $p<0.05$ as previously described by Norusis (1986).

## RESULTS

### *Effects of xylazine and propofol on some semen and serum biochemical parameters*

The overall mean values of semen and serum parameters of the pretreatment group and the xylazine treated

group at 1, 24, 72 and 192 hours are presented in Table 1. When compared with the values of the pretreatment group, significant differences ($p<0.05$) were observed in values of semen volume at 1 and 24 hours, sperm concentration at 24, 72, and 192 hours, semen glucose at 24 and 72 hours, serum testosterone and follicle stimulating hormone at 24, 72, and 192 hours. The percentage motility and live sperm percentage were not significantly affected.

In the propofol treated group (Table 2), significant differences ($p<0.05$) were observed in values of percentage motility at 1 and 24 hours, sperm concentration at 1, 24, 72 and 192 hours, serum testosterone at 1 and 24 hours and serum follicle stimulating hormone at 1, 24, 72, and 192 hours. Semen volume, live sperm percentage, and semen glucose were not significantly affected ($p>0.05$).

**Table 1.** Semen and some serum biochemical parameters in bucks before and after xylazine treatment

| Parameters | Pretreatment | 1 h | 24 h | 72 h | 192 h |
|---|---|---|---|---|---|
| Volume of semen (ml) | 0.36 ± 0.06 | 0.14 ± 0.05* | 0.29 ± 0.09* | 0.35±0.05 | 0.34±0.07 |
| Percentage motility | 70.02 ± 0.0 | 65.00 ± 0.3 | 69.00±0.7 | 69.00±0.9 | 70.01±0.7 |
| Concentration (millions/ml) | 332.27 ± 133.59 | 332.27 ± 133.59 | 101.88±108.92* | 153.13±117.31* | 160.31±107.08* |
| Live sperm % | 85.90 ± 5.39 | 85.90 ± 5.37 | 84.41±5.27 | 85.90±5.33 | 86.10±6.32 |
| Semen glucose mmol/litre | 3.51 ± 0.23 | 3.50 ± 0.23 | 2.71±0.25* | 2.80±4.21* | 3.32±0.41 |
| Serum testosterone (ng/ml) | 9.10 ± 0.42 | 9.10 ± 0.42 | 6.90±0.64* | 6.81±0.32* | 6.98±0.31 |
| Serum FSH (mIU/ml) | 367.35±23.96 | 367.35±23.96 | 18.40±15.79* | 50.321±19.30* | 103.11±11.12* |

* Significant difference at $p<0.05$ compared to value obtained before treatment

**Table 2.** Semen and serum biochemical parameters in bucks before and after propofol treatment

| Parameters | Pretreatment | 1 h | 24 h | 72 h | 192 h |
|---|---|---|---|---|---|
| Volume of semen (ml) | 0.36±0.06 | 0.32±0.08 | 0.31±0.07 | 0.31±0.06 | 0.32±0.07 |
| Percentage motility | 70.00±0.0 | 62.00±73.09* | 62.31±9.01* | 69.93±8.23 | 69.94±9.32 |
| Concentration/ml (millions) | 334.27±33.59 | 269.09±69.56* | 272.11±63.31* | 274.31±51.11* | 274.51±49.11* |
| Live sperm % | 84.90±5.39 | 86.36±5.05 | 85.73±4.33 | 84.91±3.56 | 85.37±3.15 |
| Semen glucose mmol/litre | 3.50±0.26 | 3.40±0.26 | 3.50±0.23 | 3.49±0.19 | 3.48±0.17 |
| Serum testosterone (ng/ml) | 9.11±0.42 | 0.45±0.07* | 0.51±0.03* | 8.90±7.31 | 8.89±8.11 |
| Serum FSH (mIU/ml) | 366.35±23.96 | 39.25±1.06* | 50.32±3.07* | 53.41±7.11* | 55.47±7.81* |

* Significant difference at $p<0.05$ compared to value obtained before treatment

## DISCUSSION

The statistically significant decrease ($p<0.05$) noticed in semen volume in the xylazine treated group as compared to the pretreatment group may be due to the fact that, xylazine induces a retrograde flow of spermatozoa into the urinary bladder (Hernandez, 1992; Hernandez *et al*., 1992). This decrease in volume may also be attributed to the fact that in an anaesthetized male, the pathway of least resistance appears to be for the retrograde flow of fluid into the urinary bladder because fluid flushed through the vasa deferentia at the time of vasectomy in dogs and cats (Frenette *et al*., 1986) and rams (Hernandez, 1992) flowed into the bladder. It was postulated (Dooley *et al.*, 1990) that xylazine stimulates adrenoceptors in the epididymides and vasa deferentia of dogs to induce a non-ejaculatory displacement of spermatozoa and possibly of least resistance, into the urinary bladder. Thus a consequent decrease in volume of semen was noticed as compared to the pretreatment group. In the present study, treatment with propofol was without effect on the semen volume; it could be that there are no receptors for propofol on the reproductive tract of the red Sokoto buck or if present propofol has no effect on semen volume.

In the present study, the decrease in percentage motility observed in the xylazine treated group may be attributed to a consequent decrease in semen glucose due to the hypoglycaemic effects of xylazine. The major source of energy for sperm motility in goats is fructose - a kind of sugar (Melrose, 1963) and since xylazine decreased the semen glucose level in this study, it is possible that the level of fructose may have been decreased also; this could be the reason for the decreased sperm motility.

The hypoglycaemic effect of xylazine, which may be linked with the low semen glucose noticed in this study, disagrees with previous observation in rams (Shokry *et al*., 1976) and cattle (Symonds, 1976). The decrease in semen glucose observed which is attributed to hypoglycaemia may be attributable to several factors like hyperinsulinaemia, hypoglucagonaemia, decreased hepatic glucogenesis and increased utilization and/or hepatic storage of glucose. All or some of these mechanisms may explain the hypoglycaemia recorded in the xylazine

treated red Sokoto bucks. This however disagrees with previous observations in rams and cattle by Monzaly (1975), Symonds (1976) and Thurmon *et al.* (1977). The discrepancy may be due to the breed or species differences.

A decrease in sperm concentration was observed in the xylazine, and propofol, treated groups; this may be attributed to the corresponding decrease in serum testosterone and follicle stimulating hormone levels caused by these drugs. Follicle stimulating hormone and testosterone can limit spermatogenesis. Follicle stimulating hormone is necessary to increase the level of the androgen binding protein production by sertoli cells and to develop the blood-testis barrier and other functions of the cells. Once the sertoli function is developed, testosterone alone will maintain spermatogenesis. The yield of spermatozoa, however, is increased if follicle-stimulating hormone is present.

Follicle stimulating hormone is known to increase the yield of spermatogonia by preventing atrasia of differentiating type spermatogonia. Therefore, the decreased sperm concentration noted in the present study, may be attributed to the corresponding decrease in the levels of follicle stimulating hormone and testosterone noted. The results of this study is in agreement with the findings of Doshi *et al.* (1994) who obtained a positive correlation between testosterone concentration, and total sperm count and sperm motility in buffalo-bulls treated with clomiphene citrate, indicating that low levels of testosterone was always associated with low values of semen characteristics. Brown and Chakraborty (1992) have suggested that clomiphene decreased the synthesis and/or release of gonadotropins and also decreased serum LH and testosterone concentrations in male rats.

## CONCLUSION AND RECOMMENDATION

In conclusion, the drugs xylazine and propofol investigated in this study should be used cautiously in red Sokoto bucks meant for breeding purposes; this is because these drugs have been found in this study, to decrease ejaculate volume and semen glucose level, sperm motility and concentration, serum testosterone and follicle-stimulating hormone levels in the red Sokoto buck. These parameters are indices of fertility in the male animal; there is therefore a tendency to decrease fertility when these drugs are administered to bucks meant for breeding purposes. Compliance with withdrawal period is recommended where use of any of these drugs in breeder bucks is unavoidable.

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