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IMPACTS OF IVERMECTIN (MECTIZAN(R)) ON SEMINAL ELECTROLYTE CHARACTERISTICS OF YANKASA RAMS

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ABSTRACT

Semen consists of spermatozoa suspended in a fluid medium called seminal plasma. Ivermectin (Mectizan(R)), is a well-tolerated acaricide and anthelmentic with no side-effects at pharmacological doses. The aim of this study to was examine the effect of Mectizan(R) on seminal plasma electrolyte characyteristics in Yankasa rams. Twenty apparently, healthy rams aged 1½ -2 years and weighing 25-30 kg were used for this study. Mectizan(R) was administered orally 8 times at 14 days intervals for 16 weeks at 200 mg/kg to all the rams. Semen was collected using electro-ejaculator once weekly for three weeks before the treatment and and once biweekly throughout the treatment period. Seminal plasma electrolyte; sodium, potassium, calcium, magnesium, zinc, chlorine and phosphorous were determined by atomic spectrophotometer. There was a significant ($P > 0.05$) increase in sodium, calcium, zinc and chlorine compared to pre-treatment parameters. There was no significant difference but a decrease in phosphorous, magnesium and potassium. It was concluded that repeated use of Mectizan(R) at the recommended dosage of 200 mg/kg did not alter seminal plasma composition deleteriously in Yankasa rams, and may not impair reproduction in rams.

Key words: Mectizan(R), Yankasa ram, seminal plasm electrolyte, Safety

INTRODUCTION

The male sexual functions are very sensitive to pharmacological agents. Male reproductive function is known to be highly sensitive to many chemicals and physical agents generated by industrial or agricultural activities Favareto *et al.*, 2011). Mectizan(R), a brand name for Ivermectin (Merck company, Canada), an acaricide and anthelmentic drug is a well-tolerated drug with no side-effects in mammals at pharmacological doses. It diffuses to all tissue compartments, except the central nervous system after being administered orally or through other routes (Daurio *et al.*, 1987). The reproductive activity of rams appears to be influenced by breeds, age, nutrition, geographical location, season and especially photoperiod, being the key environmental signal timing the reproductive cycle (Benia *et al.*, 2018). Ivermectin influences the reproductive potential in domestic animals without deleterious effects on seminal electrolyte or sexual desire in stallions (Janett *et al.*, 2001), rams (Schroder *et al.*, 1986), bucks (Onakpa *et al.*, 2010) and cattle (Leaning *et al.*, 1983). It improves semen quality (Bearden *et al.*, 2004) and reproductive potential in ewes (Benmoula et al., 2017). Seminal plasma is a complex biological fluid. The secretions of the epididymides and accessory sex glands modulate the function of spermatozoa and the female tract through the

provision of signalling factors and glycoproteins with sperm-binding properties (Bedford 2015). Sperm survival and fertilising potential is hampered if they are not exposed to seminal factors, and these effects are particularly noticeable if epididymal spermatozoa is deposited in the lower reproductive tract and has to migrate to the site of fertilization in the ewe (Rickard *et al.*, 2014). The prolonged survival and fertility afforded by seminal factors is a combination of its ability to stimulate motility (Maxwell *et al.* 2007), regulate capacitation (Manjunath *et al.* 2008), influence sperm storage in the female tract (Manjunath *et al.* 2007) and modulate the female immune system to tolerate spermatozoa and the conceptus (Robertson, 2007).

MATERIALS AND METHODS

Study Location

The research was carried out at the National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria.

Experimental Animals, Experimental Design and Treatment

Twenty (20), apparently, healthy rams aged 1½ -2 years and weighing 25-30 kg with clinically normal genitalia were used for this study. The rams were housed in standard pens. They were given access to *Digitaria* hay, supplementary concentrate, and water was provided *ad libitum*, acclimatised for one week prior to the commencement of the study. Thereafter pretreatment semen was collected for three weeks followed by administration of Mectizan$^{(R)}$. The drug was administered orally to all the experimental rams (n = 20) eight times at 14 days intervals for 16 weeks at 200 mg/kg to all the rams.

Semen Collection, Seminal plasma separation and seminal electrolye determination

The semen was collected in the morning 8:00 am once weekly for three weeks before and biweekly throughout the treatment period by means of a hand-held electro- ejaculator (Electrojet®, Electrovet, Sao Paulo, Brazil.Seminal plasma was separated from the collected semen by centrifugation at 3000 rpm for 30 min at 4°C and stored at −20°C until further analysis. The seminal electrolytes; Sodium, potassium, zinc, calcium, magnesium and chlorine where determined by Spectrophotometry according to the method of Willis (1960).

Data Analyses

Data were expressed as means and standard error of the mean (SEM). Data were analysed using paired Student's t-test with Statistical Package for Social Sciences (Version 20.0, SPSS®, Chicago IL, USA). Mean differences with different values of $P < 0.05$ were considered significant.

Results

There was a gradual and significant ($P<0.05$) increase in sodium ion concentration with increasing weeks of treatment compared to the pre-treatment value. However, the potassium ion concentration of the seminal plasma decreased non significantly ($P>0.05$) at post Mectizan$^{(R)}$ treatments compared to the control. Zinc ion significantly ($P<0.05$) increased with increasing weeks of Mectizan treatment compared to the pre-treatments value. Calcium ion concentrations were also observed to increase with the weeks of mectizan treatment compared to pre-treatment value. Magnesium ion concentrations of the seminal plasma decreased non significantly ($P>0.05$) with increasing weeks of Mectizan$^{(R)}$ treatment compared to pre-treatment while chloride ion increased non significantly with weeks of Mectizan treatment compared to pre-treatments and phosphorous ion concentration decreased non significantly with weeks of mectizan treatment compare to pre-treatments (Table 1).

Table 1: Effect of Ivermectin (Mectizan) on the mean±S.E.M of seminal plasma electrolytes of Yankasa rams

Weeks of Ivermectin (Mectizan) treatment									
Seminal plasma electrolyte	Treatmnt	Week 2	Week 4	Week 6	Week 8	Week 10	Week 12	Week 14	Week 16
Sodium ion	Post-treatment	203±0.23	205 ±030 [a]	201±0.30[b]	205±0.40 [a]	210±0.30 [a]	205±0.20 [a]	198±0.50 [a]	220±0.10 [a]
	Pre-treatment	200±0.20[b]	200±0.20 [b]	200±0.20 [b]	200±0.20 [b]	200±0.20[b]	200 ±0.20[b]	200±0.20 [b]	200±0.20 [b]
Potassium ion	Post-treatment	100±0.50	100.4±0.10 [a]	100.6±0.90	99.8±0.20	98.7±2.60	90.8±1.30	90.2±6.30	9± 6.50
	Pre-treatment	110±0.60	110± 0.70	110±1.20	110±0.30	110±1.20	110±0.80	110± 0.77	1108±0.30
Zinc ion	Post-treatment	121.3±0.20	122.3±0.40	130.2±0.10	125.4±0.90	124.4±0.10	128.1±0.40	123.9± 0.50	128.5±0.90
	Pre-treatment	120±0.45	120±0.44	120±0.20	120±0.40	120±0.20	120±0.50	120± 0.11	120±0.20
Calcium ion	Post-treatment	10.1±0.52.	10.7±0.40	10.5±0.21	10.6±0.43	10.8±0.30	10.5±0.32	10.5±0.53	10.4±0.82
	Pre-treatment	9.2±0.54	9.2±0.54.	9.2±0.54	9.2±0.54	9.2±0.54	9.2±0.54	9.2±0.54	9.2±0.54
Magnessium ion	Post-treatment	86±1.93	80.5±0.33	85±8.20	88±6.30	87±8.90	88±3.90	85.5±0.52	87±6.30
	Pre-treatment								

		88± 2.93	88.5±2.90	88±2.90	88±2.30	88±2.90	88±2.90	88± 2.93	88±2.90
Chlorine ion	Post-treatment	81.2±1.50	84.2±4.40	83.2±0.70	84.2±6.10	85.2±0.10	83.6±0.20	83.8±0.30	80.2±0.80
	Pre-treatment	80±0.60	80±0.60	80±0.60	80±0.60	80±0.60	80± 0.50	80±0.50	80±0.50
Phosphorous	Post-treatment	6.4±1.20[a]	5.8±0.30[a]	5.6±0.20[a]	5.9±0.10[a]	5.7±0.30	5.9±0.50	5.8±0.10	5.1±0.60
	Pre-treatment	6.1 ±0.20[a]	6.1±0.20	6.1±0.20	6.1±0.20	6.1±0.20	6.1±0.20	6.1±0.20	6.1±0.20

Mean(S.E.M) with different superscript are statistically significant

Discussion

The study showed that the use of oral Mectizan(R) repeatedly alters seminal plasma electrolyte concentrations of Yankasa rams. Seminal plasma is a carrier for sperm and contains a number of factors crucial for normal fertilization. Sodium, potassiom,, zinc , calcium, magnesium, chlorine and phosporous may indicate the seminal quality as they play a key role in the functional integrity and function of sperm cell membranes. The various concentrations of these electrolytes in this present study were comparable to the range reported by Nasrin et al (2012) who reported the various concentrations of seminal electrolytes in different domestic animals including rams. The increase in the concentrations of Sodium, Zinc, calcium and chlorine ion observed in this present study agreed with the work of Ghada *et al.* (2012), who reported similar increase in seminal plasma of bull. This increase could be attributed to central nervous system stimulation of the ivermectin and the gonads resulting increase motility of the spermatozoa due to calcium, sodium, potassium and chlorine and increase in antioxidant properties of the plasma due to increase zinc and calcium as reported by El-Nahas and El-Ashmawy (2008). The decrease in the potassium ion concentrations observed in this work agreed with the report of Abdel-Rahman *et al.* (2012). In ram, this translate to enhanced motility as increasing potassium levels are negatively correlated to progressive motility, while the reverse is true for sodium and chloride as reported by El-Nahas and El-Ashmawy, (2008). The seminal electrolytes determine the secretory and motility property of the sperms. The the decrease phosphorous concentrations also observed in this study could be due to increase in calcium concentration this agreed with the report of Wong *et al.* (2001) who showed that increase seminal plasma phosphorous concentrations could be deleterious to the sperm.

CONCLUSION

The repeated use of ivermectin has no deleterious effect on the composition of the seminal plasma in Yankasa ram. Increased concentrations of sodium, Zn, Ca may increase semen quality

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