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Effects of Selenium and Vitamin E on Mating Performance and Hormone Profile of Yankasa Rams

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Abstract: The objective of the study was to investigate the effects of selenium and vitamin E on mating performance and hormone profile of yankasa rams. Nine rams (2 – 2 ½ years of age) were used for the study. The rams were randomly assigned into 3 groups (n = 3). Animals in group I served as control and were administered 1ml normal saline. Animals in group 2 were administered 90mg Tocopherol acetate (Vitamin E), while group 3 received injection containing a combination of 100mg tocopherol acetate and 1.97mg sodium selenite. Two doses of the injections were administered 14 days apart (subcutaneously). The result indicate that administration of vitamin E and a combination of selenium and vitamin E induced higher ($p<0.05$) testosterone concentration and reduced serum level of cortisol ($p<0.05$). The mean estrogen concentration was enhanced by administration of selenium and vitamin E. However, mean values of follicle stimulating hormone, luteinizing hormone and thyroid hormone were not affected by treatment($p>0.05$). Indicators of mating performance including number of mount attempts, number of successful mounts, and total physical activity were enhanced ($p<0.05$) by treatments. It can be concluded that administration of selenium and vitamin E resulted in improved mating performance of yankasa rams. The serum cortisol level was reduced suggesting alleviation of physiological stress.
Keywords: Hormone profile, Libido, Yankasa ram, Selenium, Vitamin E.

INTRODUCTION

Reproductive biotechnology provides means whereby reproductive performance may be modified at a number of points. Puberty may be induced in prepubertal animals to increase the efficiency of the breeding herd or flock[1]. Reactive oxygen species (ROS) are free radicals such as hydroxyl radical (•OH), superoxide anion(O2•) and molecules like hydrogen peroxide (H2O2). The effect of ROS on the reproductive potential in male is a subject of extensive research worldwide. Oxidative stress occurs at the cellular level, when reactive metabolites of oxygen are produced faster than they can be safely removed by antioxidant defense mechanisms [2]. Impaired reproductive performance in both males and females of all farm animals species has been attributed to a selenium deficiency.

Reproductive inefficiency is one of the most important causes of economic losses in livestock industry[3].Selenium deficiency plays a role in numerous economically important livestock diseases, problems that include impaired fertility, abortion, retained placenta and neonatal weakness [4].Selenium has been amply documented to significantly enhance animal development, a number of metabolic processes, and the reproductive success Previous reports have suggested that vitamin E and selenium (Se) are important nutrients that act synergistically and can affect many biological processes including spermatogenesis and semen quality[5]. The association of Vitamin E deficiency with impaired male reproduction has been established. Vitamin E is essential for such body functions as growth, reproduction, prevention of various diseases, and protection of the integrity of tissues. The metabolic function of selenium is closely linked to vitamin E. Both selenium and vitamin E function to protect biological membranes from oxidative degeneration.

Vitamin E and the selenium-containing enzyme glutathione peroxidase (GSHpx) are an integral part of the antioxidant system present in all cells Vitamin E is a chain-breaking antioxidant that prevents

the propagation of free radical damage in biologic membranes, thus defending polyunsatured fatty acid (PUFA) from auto-oxidation [7]. Soil Selenium concentration in the study area have been reported to be below the critical level of 0.5mg/Kg [8]. Selenium deficiency have also been reported in legumes and crop residue in the area [9].

Cortisol is a reliable physiological indicator of stress in sheep. Adverse effects of stressors associated with animal production on reproductive physiology has been documented[10]. Stressful environment may exert glucocorticoid mediated inhibition of hormone secretion resulting in low reproductive efficiency. Selenium and vitamin E supplementation is reported to contribute to protection of seminiferous tubules and synthesis of testosterone in male reproductive system[11].

MATERIALS AND METHODS

Experiment site

This study was conducted in the livestock farm of the Department of Animal Science of College Agriculture, Lafia, Nasarawa state. The location lies within latitude $08^0$33' N and longitude $08^0$33'E at an attitude of 181.53m (570ft) above sea level with an annual rainfall of 1311.75cm

Animals and management

Nine (9) Rams (2-$2^1/_2$ years of age) weighing 36-42kg were used for the study. The animals were allowed access to grazing most of the day. Maize offal was provided as supplementary feed and Minerals salt lick and clean drinking water provided *ad libitum.* All animals were given prophylactic treatment against ecto and endo parasites, by using ivermectin (50 µg/kg subcutaneously).

Experimental Design

The completely randomized design (CRD) was used. The rams were randomly assigned into 3 groups with 3 rams in each group. Animals in group 1 serve as control and were administered1ml normal saline, animals in group 2 were administered injections of 90mg Tocopherol Acetate(Vitamin E),manufactured by Laborate Pharmaceutical (India). Ewes in group 3 received injections containing 100mg Tocopherol Acetate (Vitamin E) and 1.97 mg Sodium Selenite (Bremer Pharma GMBH) Germany. All injections were administered subcutaneously. Two doses of the injections were administered 14 days apart.

Evaluation of Serving Capacity of Rams

Sexual behavior was evaluated using techniques described by [12]. Each Ram was introduced to synchronized ewes. The number of mounts during a 15 minute period was recorded. Traits evaluated include.

- Number of Anogenital Investigation (sniffing or kicking) = (SN)
- Number of mount attempts (MA)
- Number of mount with or without ejaculations (MO)
- Number of foreleg kicks and nudge with shoulder (Kicking and nudging = KNN)
- Latency to first mount (LFM),
- Total physical activity calculated as the sum of number of fore leg kicks, attempted mounts, and mounts with or without ejaculations

Hormone Assay

Serum samples were assayed for Follicle stimulating hormone, Luteinizing hormone, Thyroxin, Cortisol and Testosterone levels using Chromo auto dry chemistry reagents.

Statistical Analysis

The data were analyzed by analysis of variance using statistical package for social science (SPSS) version 22.0. The separation of means was effected using Duncan"s Multiple Range Test (DMRT) method while statement of significance were based on $p<0.05$.

RESULTS

Summary of results for effect of treatment on libido and mating performance of rams is shown in Table 1. The mean value of latency to first mount is similar for all groups.The number of mount attempts is significantly different between treatments ($p<0.05$) with highest mean value in group 3 and the lowest in group 1.

Number of successful mounts is significantly high in group 3 compared to group1while that of groups 2 and 3 are similar.A significant difference was also observed in the number of sniffing with highest mean value in group 3 and the lowest in group 1.The number of foreleg kick and nudge is significantly lower in group 1 compared to group 3 but similar to group 2.Total physical activity is significantly lower ($p<0.05$) in group 1 compared to other groups.

The result indicates no significant difference in the mean values of Follicle Stimulating Hormone, Luteinizing Hormone and Progesterone as shown in Table 2. Mean value of Testosterone is significantly lower ($p<0.05$) in the control group compared to groups 2 and 3 which were similar.

Mean Estrogen concentration of group 3 is higher ($p<0.05$) compared to other groups which were similar. Cortisol concentration is significantly higher in the control compared to other groups which were similar.

Mean values of Thyroxin (T4) and Triiodothyronin(T3) are similar for all groups ($p>0.05$).

Table-1: Effects of selenium and Vitamin E on Libido and mating performance of Yankasa Rams (mean + sem)

Parameters	Control	Treatment		
		Vitamin E	Se + Vit. E	
Latency to first mount (min)	1.00±0.00	1.00±0.00	1.00±0.00	ns
Number of mount attempts	5.50±0.28[a]	7.00±0.00[b]	11.00±0.57c	*
Number of successful mounts	1.00±0.00[a]	1.50±2.88[ab]	2.00±0.00b	*
Number of sniffing	7.50±0.86a	12.50±1.44b	19.50±1.57c	*
Lumber of foreleg kick and Nudge	6.50±0.86[a]	11.50±1.44[ab]	12.50±0.28[b]	*
Total physical activity	12.00±1.15[a]	18.50+2.59[b]	23.50+0.86[b]	*

Means within same row bearing different superscript are significantly different.
SEM – standard error or mean, ns=Not significant
* - Significant different (P<0.05)

Table-2: Effects of selenium and Vitamin E on Serum levels of Hormones in Rams (mean + sem)

Parameters	Control	Treatment		
		Vitamin E	Se + Vit. E	
Testosterone (ng/ml)	2.60±0.17[a]	4.35±0.08[b]	5.00±0.75[b]	*
FSH (miu/ml)	0.82±0.17	0.88±0.02	0.83±0.00	ns
LH (miu/ml)	0.72±0.01	0.75±0.10	0.68±0.01	ns
Progesterone (ng/ml)	1.50±0.23	1.55±0.14	1.45±0.08	ns
Oestrogen (ng/l)	25.40±3.7[a]	25.00±0.00[a]	33.00±1.73[b]	*
Cortisol (mmol/l)	108.50±4.90[b]	90.00±5.77[a]	85.75±6.06[a]	*
Thyroxin (T_3) (ng/ml)	0.70±0.05	0.65±0.08	0.75±0.08	ns
Thyroxin (T_4) (nmol/ml)	146.00±0.05	147.00±2.31	146.00±5.77	ns

Means within same row bearing different superscript are significantly different (P<0.05).
SEM – standard error or mean, ns=Not significant
*- Significant (P<0.05)
FSH – Follicle stimulating Hormone

DISCUSSION

The result indicates beneficial effects of vitamin E and a combination of selenium and vitamin E on libido and mating performance of yankasa rams. Similarly, treatment with vitamin E alone and in combination with selenium resulted in reduced reaction time to first mount and an increase in number of mounts [13].The metabolic role of selenium is closely related to vitamin E, both act to protect body membrane from oxidative damage. The association of vitamin E deficiency with impaired male reproduction has been established [5].

Higher serum testosterone level (p<0.05) was induced following administration of vitamin E and a combination of vitamin E and selenium. Earlier reports indicate that supplementation with vitamin E and selenium contribute to protection of seminiferous tubules and synthesis of testosterone in the male reproductive system [11]. Similarly, higher serum testosterone was reported following administration of selenium and vitamin E in ossimi rams [14]. Selenium is reported to be essential for the biosynthesis of testosterone and normal function of spermatozoa [15]. Treatment had no significant effect on serum levels of follicle stimulating hormone, luteinizing hormone, progesterone, and thyroid hormones (p>0.05). Selenium dependant iodothyronine deiodenase converts thyroxin (T4) to the more active thyroid hormone, triiodothyronine (T3) [16]. However, serum level of estrogen was significantly higher in group 3 rams compared to other groups.

Serum cortisol level of the control group was significantly high compared to that of other groups. Elevated serum levels of glucocorticoids suppress pulsatile release of luteinizing hormone by inhibiting pituitary responsiveness to gonadotrophin releasing hormone [17].

CONCLUTION

The result of this study indicate improved mating performance of yankasa rams in response to administration of selenium and vitamin E. Favorable physiological responses indicating alleviation of stress was also induced.

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