EFFECT OF ZINC AND SELENIUM SUPPLEMENTATION ON SEMEN QUALITY OF BARBARI BUCKS

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ABSTRACT
The present study was conducted to investigate the effect of supplementation of zinc and selenium on semen quality in twelve Barbari bucks of proven fertility. The experimental animals were randomly divided into two groups of six and fed without any supplementation (control) or with 150-ppm zinc sulfate and 0.50-ppm sodium selenate (test group). Semen was collected on days 0, 60, 75, 90 and 105 to study its characteristics. In control group, no significant change was observed in semen quality during the study period. In test group, semen quality was improved in terms of a significant (P< 0.05) increase in semen volume, progressive motility, sperm count, percent live spermatozoa, acrosomal integrity and hypo osmotic swelling (HOS) responding spermatozoa and decrease in abnormal spermatozoa after 60 days of supplementation. Mass motility increased significantly (P< 0.05) only at 105 days as compared to 0 day. It is concluded that the supplementation of Zn and Se can improve semen quality in goats.

Key words: Buck, Selenium, Semen quality, Zinc.

INTRODUCTION
Agricultural production system in developing countries is under pressure to fulfill the requirement of growing population, which has led to indiscriminate use of fertilizers resulting in severe deficiency of micro minerals in soil. Moreover, some regions are naturally deficient in these micro minerals (Singh et al., 2005). The deficiency of Zinc (Zn) in soil and crop plants has been reported in many countries like India, China, Turky and Pakistan (Sillanpana 1982; Rashid and Ryan 2008). The soil in the Indian subcontinent is also deficient in selenium (Se).

Zn is an essential nutrient and indispensable element in growth and reproduction. Zn helps in testicular growth and development of seminiferous tubules, spermatogenesis, steroidogenesis in testes, synthesis and secretion of follicular stimulating hormone (FSH) and luteinizing hormone (LH) (Underwood 1977; Habib 1978 and Bedwal and Bahuguna 1994). The antioxidative property of Zn prevents lipid peroxidation and stabilizes lysosomal membrane (Kimball et al., 1995) and hence improves fertility (Bray et al., 1997). Selenium (Se) is present in the mid piece of spermatozoa and is associated with Cys-rich protein of the mitochondrial sheath (Kleene et al., 1990). A deficiency of Se causes changes in mid-piece architecture leading to breakage of head and tail of sperms and impaired sperm motility (Maiorino et al., 2006).

Therefore, the present investigation is intended to study the effect of dietary supplementation of Zn and Se on semen quality in Barbari buck.

MATERIALS AND METHODS
Animals and experimental design: The present study was conducted on twelve Barbari bucks (3.2±0.12 years), weighing 33±1.5 kg, reared at Department of Physiology, College of Veterinary Science and Animal Husbandry, Mathura from 16 January to 1 May 2010 where the mean minimum, maximum temperature and humidity was 14, 31.58°C and 51.96% respectively during the study period, located at 27°N latitude and 78° E longitudes, 176m above the sea level. The animals were grazed in a flock in Institute’s pasture land daily from 9.00 AM to 3.00 P.M., and supplemented with 250g

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concentrate mixture having DCP 13% and TDN 69% per animal daily with free access to water. All the experimental animals were regularly dewormed for internal parasites. The experimental protocol was approved by the ethical committee of Veterinary University, Mathura.

The experimental animals were divided randomly into control and test groups containing six animals each. The animals of the control group were not given any supplementation whereas animals of the test group were supplemented with 150 ppm zinc sulfate (150 mg/Kg dry matter intake of the animal) and 0.50-ppm sodium selenate (0.50 mg/Kg dry matter intake of the animal) for the entire duration of the experiment. Zinc sulfate and sodium selenate was dissolved in triple distilled water and was drenched orally. Semen was collected on days 0, 60, 75, 90 and 105 to analyze semen quality.

**Semen collection and evaluation:** The donor bucks were trained for semen collection and semen was collected in the morning hours using artificial vagina. A non-oestrous doe was used for mounting of males, and semen was collected into the graduated cups with an accuracy of 0.10 ml attached to one end of the artificial vagina.

Semen quality was evaluated in terms of gross motility (Graham et al., 1970), progressive motility, sperm concentration (hemocytometer chamber method), percentage live spermatozoa and morphological abnormalities (Hancock, 1952) and acrosomal integrity (Mendoza et al., 1992) using NIKON TE 2000-S fluorescent microscope. The hypo-osmotic swelling test was performed according to the methods described by Jeyendran et al. (1984).

**Statistical analysis:** The effect of supplementation of Zn and Se on different parameters at different days in control and test groups was analyzed using two way analysis of variance followed by Tukey’s post hoc test using the SPSS/PC computer program (version 14.0; SPSS, Chicago, IL).

**RESULTS AND DISCUSSION**

Except day 0, there was significant change (P<0.05) in the different seminal attributes between control and test groups during the period of the experiment. In control group, no significant change (P>0.05) was observed in different semen quality parameters at different intervals (Table 1). In test group, semen volume, progressive motility, sperm count, percent live spermatozoa, acrosomal integrity and hypo osmotic swelling (HOS) responding spermatozoa increased significantly (P<0.05) whereas abnormal spermatozoa decreased significantly (P<0.05) after 60 days of supplementation as compared to 0 day (Table 1). Mass motility increased significantly (P<0.05) only at 105 days as compared to 0 day (Table 1). In test group, sperm count and HOS responding spermatozoa increased significantly (P<0.05) and abnormal spermatozoa decreased significantly at 105 days as compared to 60, 75, and 90 days (Table 1).

The beneficial effect of Zn and Se supplementation was observed on semen volume after 60 days. Similar results were also reported by Shi et al. (2010) in buck, Kendall et al. (2000) and Scott et al. (1998) in ram, Marin-Guzman et al. (1997, 2000) in boar, Hawks and Turek (2001) in human and Wu et al. (1973) in rat either after supplementation of zinc and selenium together or separately. Zn stimulates the growth and development of primary and secondary sex organs (Kynaston et al., 1988), spermatogenesis (Underwood and Somers 1969) and especially prostate functions (Mann 1964) in various species. Therefore, the increased semen volume could be due to stimulatory influence of Zn on secretory function of these organs.

Increase in mass motility, progressive motility, sperm concentration, live spermatozoa and decrease in abnormal spermatozoa observed in the present study is in agreement with earlier reports of improvement of semen quality in buffalo (Alvi-Shoushtari et al., 2009), bulls (Kumar et al., 2006 and Cupic et al., 1998), boar (Marin-Guzman et al., 1997, 2000), ram (Kendall et al., 2000) and buck (Shi et al., 2010). Combined supplementation of Zn and Se produced more efficient protection to spermatozoa (Said et al., 2010). Zinc and selenium act as cofactor for the synthesis of antioxidative enzymes, superoxide dismutase and glutathione peroxidase. Thus, increase in antioxidative status might be responsible for increased acrosomal integrity and HOST responding spermatozoa as the reactive oxygen species which are continuously produced in spermatozoa membrane might have
been neutralized by antioxidant enzymes. Selenium level in blood serum is also positively correlated with acrosomal integrity (Bertelsmann et al., 2010).

**CONCLUSION**

It is concluded that the supplementation of Zn and Se for 60 days in Barbari bucks improved the semen quality.

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