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Effect of Pre-partum Supplementation of Vitamin E and Selenium on Post-partum Reproductive and Productive Performance in Dairy Cows

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ABSTRACT

Background: The study was planned to determine the effect of oral supplementation of vitamin E and Selenium on productive and reproductive performance in 40 Jersey cows and consequent effect on the growth of their progeny (calves).

Methods: The experimental animals were divided into two homogenous groups (A and B). Animals in group A were given Vitamin E (200 mg) and Selenium (10 mg) daily orally; 250 days onwards prepartum for 21 days. The cows belonging to the group B were not provided these supplements and served as untreated control group.

Result: Group A animals took significantly (P<0.01) less (2/3) time than those included in Group B for expulsion of the placenta. Additionally, lesser number of cows in Group A than those in Group B suffered from retention of placenta (ROP) indicating improvement of reproductive performance in the group with no significant effect on growth of calves and milk yield in the two groups. Therefore, from the experiment, it was concluded that supplementation of Vitamin E and Selenium to dairy cows during last month of pregnancy decreases time of placenta expulsion with no significant effect on the growth of their progeny (calves). The present study also concludes that higher number of animals may be taken for the experiment for a good dairy managemental programme.

Key words: Retention of placenta, Selenium, Stress, Transition of period, Vitamin E.

INTRODUCTION

During last few weeks of gestation, dairy cows near term experience reduced feed intake attributed to the reduction in rumen capacity associated with the growing fetus. It ultimately leads to the negative energy balance, insulin resistance and immune suppression (Mordak and Anthony, 2015). The additional stress of fast changing physiological status and hormonal profile makes animals vulnerable to infections, deficiency diseases and productive losses subsequently. Various strategies are tried currently for mitigation of the periparturient stress including supplementation of different antioxidants (Abuelo *et al*., 2019). Vitamin E and Selenium (Se) are essential micronutrients which share a common biological role as antioxidants (Bendich, 1990). As per the available literature, studies evaluating use of Vitamin E and Se to address the periparturient reproductive and production diseases in cows have shown contrasting results (Arrehiga *et al*., 1994 and Bouwstra *et al*., 2010). This study was therefore designed with an objective to determine the effect of prepartum oral supplementation of Vitamin E and Se on production and reproduction in near-term dairy cows and also growth performance of their calves.

MATERIALS AND METHODS

Forty healthy cows in advanced gestation (> 250 days) in 2nd and 3rd parity reared in Mountain Livestock Research Institute (MLRI), Manasbal were included in the study. Cows were randomly and equally distributed to Group A or Group B.

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Animals in Group A were given Vit E (200 mg) and Selenium (10 mg) (E-CARE Se) daily orally; 250 days onwards for 21 days. During the Experiment the cows were fed roughage to concentrate ration of 60:40 with 40% silages and 60% fodder along with compound cattle feed as concentrates. The cows belonging to the Group B were not

provided these supplements and acted as untreated control. The animals were kept in separate calving boxes one week prior to the expected calving date. After parturition, the birth weight of all the calves was recorded. The cows were subsequently shifted to milking shed and their daily milk yield recorded for a period of three months. Efficient estrous detection was attempted to inseminate (AI) the dams around 60 days postpartum. All the animals were clinically examined daily for four months postpartum for timely diagnosis of any illness particularly clinical mastitis, metritis or pyometra. Conception was confirmed by per rectal pregnancy testing 60 days post artificial insemination (AI). The calves were again weighed at weaning (90 days).

One-way ANNOVA was used to test the means between the two groups. All the statistical analysis was performed using SPSS package software.

RESULTS AND DISCUSSION

Group A animals took significantly (P<0.01) less time (4.26 hours) than those included in Group B (6.42 hours) for expulsion of the placenta (Table 1). Additionally, lesser number (n=2) of cows in Group A than those in Group B (n=3) suffered from ROP (Table 2). Jovanovich *et al.* (2013) found higher blood Se and glutathione peroxidase activity in animals supplemented with parental dose of vitamin E and Se at 255 days of gestation. In these animals, the fetal villi had separated from the maternal caruncles within a few hours of calving. At calving, stress increases cortisol level in the blood, which may lead to immune-suppression and consequently delay in the chemotatic pathways of placental separation (Goff and Horst, 1997).

The days open and services per conception between the two groups showed no significant (P>0.01) difference. This finding is in concurrence with the earlier study of Moeini *et al.* (2009), however, on the other hand Arrehiga *et al.* (1994) reported improvements in fertility. They assumed that the level of Se administration/feeding, its interaction with Vit E and/or other nutritional components such as protein, energy, mineral intake may influence the reproduction rates.

As compared to the cows belonging to Group A (10%), number (15%) in Group B were affected with ROP. Similarly the metritis/pyometra was found in group B (5%) with no case in group A. Also mastitis (20%) was found in group B with half of its percentage (10%) was found in group A (Table 2). During the periparturient period (a critical period in the life of the cow) dairy cows experience reduced feed intake, negative energy balance, insulin resistance, hypocalcemia, reduced immune function, as well as the periparturient bacterial contamination of the uterus. Due to these changes, the normal efficient maternal immune response is impaired leading to ROP in cows (Kimura *et al.,* 2003).

The prepartum supplementation of Vitamin E and Se increases the concentrations of á-tocopherol in serum and tissues. The increased antioxidant status of peripartum cows has been linked to improved immune competence, which probably plays an important role in timely shedding of the fetal membrane (Kimura *et al*., 2002). On the other hand, the higher levels of oxidative stress two weeks before calving has been related to increased incidence of clinical mastitis (Bouwstra *et al*., 2010). This argument is further supported by Politis *et al*. (2012), who found that low levels (<2 µg/m) of blood α-tocopherol at calving are associated with increased incidence of mastitis and the probability decreases manifold due to peripartum supplementation of Vit E.

The results of this study indicate similar milk yield in animals of both the groups (Table 3), which is in agreement with Brozos *et al*. (2009). However, Moeini *et al.* (2009) have reported beneficial effects during the subsequent lactations. The reported contradictory effects of Vit E and Se supplementation on subsequent lactation may be attributed to differences in the dosage, route and duration of supplementation.

The calves born from the dams included in the two groups showed no significant (P>0.01) difference in birth

Table 1: Effect of pre-partum oral supplementation of Vit E and Se on reproductive performance in dairy cows.

Parameter	Group A (Treatment)	Group B (Control)
Placental expulsion time (hrs)	4.26 ±1.10	6.42**±2.08
Days open	87.42 ±31.06	91.08±33.52
Services/conception	2.12 ±1.32	2.38±1.24

**Means bearing superscript within a row vary significantly (P<0.01).

Table 2: Effect of pre-partum oral supplementation of vitamin E and Se on postpartum diseases.

Diseases	Group A (n=20)		Group B (n=20)	
	Cows affected	%	Cows affected	%
Retention of placenta	2	10	3	15
Metritis/Pyometra	0	0	1	5
Mastitis	2	10	4	20

Table 3: Effect of pre-partum oral supplementation of vitamin E and Se on subsequent lactation yield.

Month after calving	Daily milk yield (ltrs)	
	Group A	Group B
Ist	7.21±2.20	7.47±1.90
2nd	6.62±1.55	7.05±1.10
3rd	6.18±0.73	6.22±1.05

Means within a row don't vary significantly (P>0.01).

Table 4: Effect of pre-partum oral supplementation of vitamin E and Se on body weight (Kg) in calves.

Parameter	Group A	Group B
Birth weight	23.20±3.61	24.13±3.43
Weaning weight	55.35±9.47	54.75±8.32
Body weight gain	32.05±9.67	30.92±8.53
Daily weight gain	0.356±0.12	0.343 ±0.10

Means within a row don't vary significantly (P>0.01).

weight, weaning weight, body weight gain and daily weight (Table 4). Similar observations have been documented by many workers like Mohri *et al* (2005) and Moeini *et al*. (2009). Although Vit E may pass through placental membranes as well as mammary glands; therefore, the diet of the dam may directly influence the vitamin E concentrations in nursing calves. The small amounts of vitamin E are also transferred from dam to the young in utero, however this enhanced immune status couldn't translate into better performance in terms of growth of calves. This finding corroborates well with Debier and Larondelle (2005).

CONCLUSION

Supplementation of Vitamin E and Selenium to dairy cows during last month of pregnancy may decrease time of placenta expulsion. Studies involving higher number of animals, varying duration of the supplementation and the expenses involved are required to be taken in future.

Conflict of Interest: None.

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