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Effect of prepartum vitamin E and selenium supplementation along with cloprostenol or methylergometrine maleate during puerperal period on post-partum reproductive and productive performance of cross bred dairy cattle

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Abstract
The present study was designed to evaluate the effect of vitamin E and selenium injected pre partum along with $PGF_{2\alpha}$ or Methylergometrine maleate administered after calving on postpartum reproductive and productive performance in cross bred dairy cows. A total of 40 pregnant animals in their last trimester were selected and divided into 4 Groups with 10 animals in each group. Animals in Group I, II and III were given two injections of vitamin E and selenium (Inj. Repronol, cadila pharmaceutical ltd.) 7 days apart (I^{st} injection given at 30-60 days before the expected date of calving), while animals in Group IV were kept as control. Animals in Group I and II were also administered with 2 ml $PGF_{2\alpha}$ (inj. Pragma, 500µg, I/M, Intas Pharmaceuticals ltd.) and 5 ml Methylergometrine maleate (Inj. Nexbolic, 5mg, I/M, Intas Pharmaceuticals ltd) respectively, immediately after calving. However, animals in group III and IV were given 10 ml NSS I/M just after parturition. The time required for expulsion of placenta, uterine involution, occurrence of I^{st} post-partum heat, conception rate were recorded. The placental expulsion period and uterine involution period was significant higher in Group IV as compare to Group I, II and III animals. Conception rate was observed higher in Group II (80%) animals followed by 70%, 50% and 40% in Group I, III and IV respectively and there was a non-significant increase in colostrum production, lactational yield, lactational length and mean calf birth weight in pre partum vitamin E-Se supplemented animals as compare to non-supplemented animals.

Keywords: Cattle, Methylergometrine, $PGF_{2\alpha}$, pre partum, post-partum, vitamin e-Se

Introduction
The post-partum period of dairy cow determines productive and reproductive responses during lactation and is therefore, a pivotal time in the production cycle of the cow. During this period, immune suppression commonly occurs and cows suffers to a number of diseases which dramatically affects reproductive efficacy of animals causing considerable economic loss to dairy industry due to slower uterine involution, reduce reproductive rate, prolonged inter conception period and calving interval, high cost of medication, drop in milk production, reduced calf-crop and early depreciation of potentially useful animals (Resum *et al.* 2017) [18] However, Successful attempts have been made to improve the reproductive as well as productive performance of cows and buffaloes by providing them with vitamin E-selenium during late gestation (Qureshi *et al.* 2010; Resum *et al.* 2016) [15, 17]. Which as a cellular antioxidant, interacts with selenium containing glutathione peroxidase (GPx) to prevent the oxidative breakdown of tissue membranes. The role of vitamin E and Se supplementation in maintenance of health and fertility in dairy cows has been widely investigated and responses have been manifested as increases in fertilization and pregnancy rates, reduction on the number of days open, decrease in the incidence of ovarian cyst, and retained placenta (Harrison *et al.* 1984; Graham, 1991) [6, 4].
Methylergometrine is a smooth muscle constrictor that now a days has been widely used for enhancement of uterine contraction after parturition, treatment of postpartum retained placenta, metritis and uterine involution after manual correction of prolapsed uterus (Patel *et al.* 2014) [13]

Alagar *et al.* (2016) [1] reported that administration of Methylergometrine maleate immediate during post-partum period effectively hastened the uterine involution rate in HF cross bred cow. $PGF_{2\alpha}$ is an excellent reproductive management tool for dairy cows. Administration of $PGF_{2\alpha}$ during fresh period has been shown to have favourable effect on fertility including a shortened time to first service, increase estrus detection efficiency, improved uterine health and improved first service conception rate. Patel *et al.* 2016 [12] reported that use of the $PGF_{2\alpha}$ immediately after parturition in cows induced earlier postpartum estrus suggesting its strong luteolytic effect and early resumption of ovarian activity. Keeping in view all above facts, the present study was conducted to investigate the combined effect of Vitamin-E-Selenium and $PGF_{2\alpha}$ or Methylergometrine maleate on reproductive and productive parameters of cross bred dairy cows.

Material and Methods

Experimental location

The present study was conducted at the Military Dairy Farm Jammu (J&K) during the period between October 2014 to January 2017

Selection of the Animals

Forty crossbred cows in their last trimester of pregnancy (30-60 days pre partum), aged between 4-8 years, with parity 2 to 5 were randomly selected and assigned to four experimental groups with 10 animals in each group. The details of treatment schedule has been depicted in Table 1. Animals in group I, II and III were given two injections of vitamin E and selenium (Inj. Repronol, containing 50 mg α-tocopheryl acetate and 1.5 mg selenium per ml, (Cadila Pharmaceuticals ltd) @ 1ml/50 kg body weight I/M. First injection was given at 30 to 60 days before the expected days of calving followed by a second injection 7 days later, while animals in group IV were kept as control. Animals in group I and II were also administered $PGF_{2\alpha}$ (Inj. Pragma, 500µg, I/M, Intas pharmaceuticals Ltd.) and Methylergometrine maleate (Inj. Nexbolic, 5mg, I/M, Intas Pharmaceuticals ltd) respectively, immediately after calving. However, animals in group III and IV were given 10 ml NSS I/M just after parturition.

Table 1: Grouping of animals

Group I	Group II	Group III	Group IV
Inj. Vitamin E- Se (pre partum) + Inj. PGF2α (2 ml, I/M) after calving.	Inj. Vitamin E- Se (pre partum) + Inj. Methylergometrine Maleate (5 ml, I/M) after calving.	Inj. Vitamin E- Se (pre partum) + Inj. 10 ml NSS, I/M, after calving.	Inj. 10 ml NSS (Pre partum) + Inj. 10 ml NSS, I/M, after calving.

Managemental Practices

The experimental cows were maintained under general management practice as followed for rest of the herd. They were fed ration consisting of concentrates (groundnut cakes, mustard cake, maize grain and wheat bran), roughages (either berseem and maize or oat fodder), mineral mixture and salt. Fresh tap water was available *ad libitum.* All the experimental cows were observed closely before, during and after parturition. Cows were made to parturate in individual pen and time required for expulsion of fetal membrane was recorded. Within two hours after parturition, colostrum was removed by hand milking and total colostrum quantity was measured for three consecutive days. The cows were per rectally explored twice a week after one week postpartum to assess the uterine involution period. Estrus was detected by parading bull followed by visual observation of estrus sign twice in a day and later confirmed by genitalia examination per rectum. The cows found in true estrus were artificially inseminated using frozen thawed semen of acceptable quality, 10 to 12 hours after the onset of estrus. Pregnancy diagnosis was done by rectal examination after 60 days post service. Lactation length, lactation yield and birth weight of calves born to the control and treated cows were also recorded.

Statistical Analysis

For evaluating the effect of different treatment protocol on postpartum reproductive and productive performance of cross bred dairy cows, data analysis was done by using one way ANOVA (using SPSS-16.0 Inc).

Results

The results of the present study are summarized in Table 2, 3 & 4 respectively. The mean time required for placental expulsion, uterine involution and first post-partum heat was significant (P<0.05) longer in group IV as compare to group I, II and III animals. Also group I & II shows significant (P<0.05) shorter placental expulsion, uterine involution and first post-partum estrus period as compared to group III animals. Group II animals shows better first service conception rate as compare to Group I, III & IV animals. The overall conception rate in the present study was recorded as 70.00%, 80.00%, 50.00% and 40.00% for Group I, II, III and IV respectively. The conception rate was highest in Group II (80.00%). Productive performance data shows supplementation of Vitamin E- Se tend to increase colostrums production, lactation yield and lactation length as compare to control animals.

Table 2: Effect of different treatment on reproductive performance of cross bred dairy cows

S. No	Parameters	Group I	Group II	Group III	Group IV
1	Expulsion of fetal membrane (Hrs)	4.76 ± 0.39^{a}	4.55 ± 0.41^{a}	6.23 ± 0.55^{b}	8.93 ± 0.72^{c}
2	Involution of uterus (Days)	39.92 ± 1.44^{a}	37.81 ± 1.37^{a}	48.40 ± 2.68^{b}	65.40 ± 2.34^{c}
3	First post-partum heat (Days)	50.30 ± 2.10^{a}	49.66 ± 1.96^{a}	52.90 ± 2.23^{b}	70.11 ± 2.49^{c}

The values having different small superscripts within a row differ significantly (P<0.05).

Table 3: Effect of different treatment on conception rate of cross bred dairy cows

S. No	Parameters	Group I	Group II	Group III	Group IV
1	1st service conception rate	4/10(40.00%)	6/10(60.00%)	4/10(40.00%)	1/10(10.00%)
2	2nd service conception rate	1/6(16.66%)	1/4(25.00%)	0/6(0.00%)	2/9(22.22%)
3	3rd service conception rate	2/4(50.00%)	1/3(33.33%)	1/6(16.66%)	1/7(14.28%)
4	Over all	7/10(70.00%)	8/10(80.00%)	5/10(50.00%)	4/10(40.00%)

Table 4: Effect of different treatment on productive performance of cross bred dairy cows

S. No	Parameters	Group I	Group II	Group III	Group IV
1	Colostrum (Lt.) 1st three days	6.28±0.42[a]	6.30±0.39[a]	6.11±0.31[a]	5.93±0.50[a]
2	Avg. Birth wt. Of calves (kgs)	24.33±1.14[a]	25.50±1.42[a]	24.60±1.36[a]	23.33±1.09[a]
3	Lactational yield (Kgs)	3490±252.60[a]	3550±191.71[a]	3472±292.30[a]	3032±214.76[a]
4	Lactational length (Days)	290±10.11[a]	292±12.67[a]	288±9.72[a]	271.50±12.23[a]

The values having different small superscripts within a row differ significantly ($P<0.05$).

Discussion

Findings of the present study are in agreement with that of Resum *et al.* (2016) [17] who reported significant shorter expulsion period and uterine involution period in animals supplemented pre partum with vitamin E- Selenium as compared to control animals. However, group I & II shows significant ($P<0.05$) shorter placental expulsion, uterine involution and first post-partum estrus period as compared to group III animals. These findings are in agreement with Patel *et al.* (2016) [12] who reported beneficial effects of $PGF_{2\alpha}$ or Methylergometrine administration after calving in cross bred cows.

Supplementing vitamin E-Selenium prepartum significantly increased neutrophil chemotaxis (Politis *et al.* 1996) [14] which possess greater phagocytic activity at calving thus boosting immunity of animal which might be a factor for quicker recognition of fetal membrane by animal immune system (Resum *et al*. 2016) [17]. Administration of Methylergometrine maleate just after parturition greatly reduces incidence of placental retention and enhance uterine involution (Patel *et al.* 2014) [13]. Alagar *et al.* (2016) [1] reported faster uterine involution in cows treated with methylergometrine post calving indicating the role of uterotonic drugs in reducing the size of uterus after calving. Better conception rate in this group might be due to early shedding of fetal membrane and early uterine involution which has a positive impact on reproductive performance of dairy cattle. Inadequate production of endogenous prostaglandin has been associated with delay in uterine involution postpartum (Kindahl *et al.* 1984; Madej *et al.* 1984) [8, 11]. Administration of $PGF_{2\alpha}$ in early postpartum period has been shown to accelerate uterine involution and early return to fertile ovarian cyclicity (Lindell and Kindahl, 1983) [10]. Similar results regarding uterine involution following PGF2α administration in early postpartum were also reported earlier in cattle (Raut *et al.* 2016) [16]. Jayakumar and Balakrishnan (2012) [7] reported shorter uterine involution period and high conception rates in animals treated postpartum with $PGF_{2\alpha}$. Patel *et al*. (2016) [12] reported that injecting $PGF_{2\alpha}$ after calving has direct effect on bovine ovary causing luteolysis of pregnancy CL and thus accelerate postpartum ovarian activity. However, Young (1989) [20] reported improved conception rate with $PGF_{2\alpha}$ injected at early postpartum period was not the consequences of luteolysis rather the result of myometrial contraction which accelerated uterine involution (Garcia-villar *et al.* 1987; Gustafsson, 1984) [2, 5].

Productive performance data shows supplementation of Vitamin E-Se tend to increase colostrums production, lactation yield and lactation length. Similar findings were reported by Resum *et al.* (2016) [17] who reported non-significant increase in colostrum production, lactational yield and lactational length in pre partum vitamin E-Se supplemented animals as compare to non-supplemented animals. Glutathione peroxidise is a selenium containing enzyme that in combination with vitamin E catalyses the reduction of hydro peroxidase and a range of lipid hydro peroxidase to protect biological membrane from oxidative stress which might be a reason for increase milk yield in supplemented animals (Resum *et al.* 2016) [17]. Vitamin E is a lipid soluble antioxidant that increases the efficacy of neutrophils by preserving them from intra cellular killing of ingested bacteria (Herd and Stowe, 1991) [4], Which helps in decreasing the incidence of mastitis in supplemented animals leading to increase milk production (Resum *et al.* 2016) [17]. Lacetera *et al.* (1996) [9] reported 10% increase in milk production in animals supplemented with vitamin E. Birth weight of calves born to animals supplemented pre partum with vitamin E and selenium was non-significant higher as compare to calves born to un-supplemented animals. Similar findings were reported by Godfrey and Barker (2000) [3] and Resum *et al.* (2016) [17] who reported better growth performance of calves of vitamin E-Se supplemented animals which might be due to sparing effect of selenium on fetal body mass (Godfrey and Barker, 2000) [3]. Pre partum Supplemention of vitamin E and selenium shown to enhance the secretion of immune proteins, immunoglobulin in colostrum by 80% and ameliorate growth and immune status and growth performance of the calves. (Resum *et al.* 2016) [17]

Conclusion

Administration of $PGF_{2\alpha}$ or Methylergometrine maleate after calving in pre partum vitamin E-Se supplemented animals have shown positive effect in improving the post-partum reproductive as well as productive parameters in cross bred dairy cattle in the present study.

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