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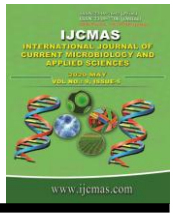

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Effect of Supplementation of Trace Minerals and Vitamins during Transition Phase on Lactation Performance of Deoni Primiparous Heifers

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A B S T R A C T

The present study was carried out at the Livestock Research Complex, SRS, NDRI, District Bengaluru, India. Twelve indigenous Deoni heifers in their last month of gestation period were selected based on their dam's lactation yield and lactation length. The cows were randomly divided into two groups of six each. The treatment group offered during transition period (-21 to +21 days respective to calving) with locally available trace minerals Cu (137 img), Zn (560 img), Mn (428 img), Se (1.5 img) and Vit-A (50,000 I.U), Vit-E (1100 I.U), β-carotene (300 mg) per animal per day, as per NRC (2001) recommendations, over and above the basal diet. The experimental cows were monitored for 180 days for lactation performance *viz.*, average total milk yield, peak yield, days to reach peak yield. The supplementation showed no effect on any of the lactation parameters in Deoni primiparous heifers.

Introduction

Micronutrients are generally considered essential as they play a major role in reproductive performance and are mainly inevitable for execution at the tissue level metabolism. Along with that, they also take part in initiation and maintenance of lactation in dairy cows because majority of them acts as antioxidants and thus aids in supporting the udder health. A healthy udder yield fresh, normal and more milk. Through continued research, it is cited that their concentrations in blood plasma often decrease around calving to

encounter pregnancy and lactation stress and extra supplementation is recommended in some dairy herds. The significant effect of micronutrient supplementation on milk yield and its quality in dairy cows is reported by various authors (Girard and Matte, 2005; Griffiths *et al.,* 2007; Bourne *et al.,* 2008). The basic reason for the role of micronutrients to enhance milk production is that they help to improve the utilization of low quality forages. The minerals especially Zn, Mn, Cu and Se along with Vit- A, E and beta carotene are the key elements utilised in the process of formation of milk carbohydrate, fat and protein. They are vital in bagging the maximum genetic potential of the animals in relation to production. However, very limited literature is available on the roles of micronutrients on the milk production in dairy cattle and so for our indigenous breeds.

The wide gap between the demand and supply of nutrients and energy during transition period due to initiation of milk secretion and other metabolic changes is associated with metabolic disorders and decreased productivity (Grummer, 1995; Mutoni *et al.,* 2012). The difference between the requirement and availability of the essential micronutrients always plays a major role in determining the production efficiency of the animals (Yang *et al.,* 2011). Therefore, it is always important to provide animals the required amount of micronutrients through diet to maintain optimum milk quality and production (Weiss and Wyatt, 2002; Cortinhas *et al.,* 2010).

The feeding of complexed trace minerals during either a long or short term experiment around late dry and early lactation showed a positive effect on milk yield (Siciliano-Jones *et al.,* 2008; Hackbart *et al.,* 2010). However, Sharmin *et al.,* (2010) found a non significant increase in average daily milk yield by 1.03 kg/d after supplementing vitamix powder in Sahiwal animals during 60 days prepartum to 30 days post calving. Similar results are reported by (Gowda *et al.,* 2004; and Iwanska *et al.,* 1999).

Materials and Methods

This study was carried out at the Livestock Research Complex, SRS, NDRI, Adugodi, District Bengaluru, India. Twelve Deoni heifers in their advance pregnancy, a month before parturition were selected on the basis of their dam's lactation yield and length. All the heifers were kept under similar managemental conditions. All of the pregnant heifers were divided into two groups of six each, with group-I served as treatment and group-II were control.

The feeding of both the groups of animal was similar during the entire study period. During the transition period (-21 to +21 days) the treatment animals were offered combination of inorganic minerals and vitamin over and above this basal diet. The treatment animals were fed Vit-E (1100 I.U 50 % α-tocopherol acetate), Vit-A (50,000 I.U Vit-A palmitate chewable tablets), β-carotene (10% powder *DUNALIELLA SALINA*) purchased from local market. The trace minerals copper (70 ppm/d/cow), zinc (280 ppm/d/cow), manganese (210 ppm/d/cow), selenium (0.7 ppm/d/cow) were offered in the form of cupric carbonate, zinc carbonate, manganese carbonate and sodium selenite, respectively. All the micronutrients were accurately weighed daily and mixed with a small amount of concentrate and directly fed to the animals.

The milking was done twice daily in the morning and evening at scheduled timings. The milking records were maintained throughout the experimental period (180 days). The daily milk yield was recorded for further analysis and also a close observation on lactation performance was done to estimate the peak yield and days to reach peak yield in Deoni primiparous heifers.

Statistical analysis

The observations for lactation performance were analyzed by using unpaired t-test (Prism Statistical Software Analysis Tool) for comparison between the control and treatment group at one time point.

Results and Discussion

The supplementation of trace minerals and vitamins during transition phase did not found to influence the lactation yield in Deoni primiparous heifers. The average milk production per cow (180 days) were found to be non significantly ($p>0.05$) higher in the control animals than the treated animals (table-1). The similar results were found for the peak yield production with control animals producing more milk than the treated animals (table-1). The treated animals took non significantly lesser days to reach peak yield than the control animals (table-1). The present findings of this study was found in consensus with the findings of Sattar *et al.,* (2007) as they also reported a non significantly lower lactation yield in treatment animals after supplementation of Vit-E and Se.

However, during the transition period that was the period of micronutrients supplementation, when a week wise (postpartum) production analysis carried out the supplemented group yields non significantly more than the control group (table-2). But for overall six month period (180 days) when month wise (table-3) production analysis carried out, it was found to be non significantly lower in supplemented than control animals (Fig. 1).

The findings of the present study are also according to the findings of Machado *et al.,* (2013) and Ramos *et al.,* (2012). However the present findings are not in consensus with the findings of Chawla and Kaur (2004) and Anton *et al.,* (2013). The present effect observed on the milk yield could be due to the lesser duration of the supplementation period in the experiment and the recording of the lactation parameters exceed by far this period of supplementation. The meta-regression analysis performed by Rabiee *et al.,* (2010) revealed that the type of trace minerals and the duration of treatment before and after calving along with the use of other supplements were the main factors influencing the milk yield. Also the nearly similar milk yield observed in supplemented group than the control cows during the period of supplementation (table-2) clearly suggest that there is some beneficial effect of the micronutrient in the early post-partum (first month) period, which is the moment of greater mineral and metabolic imbalance because of the combined effect of low appetite and higher metabolic demands for lactation. The pre experimental levels of minerals and vitamins could also have major influence on the production performance of animals.

In the present study, a non significant difference is observed between control and supplemented group for peak yield and days to reach peak yield (table-1). The control group showing a higher peak yield with slight delay to reach the day of peak yield than supplemented group. The present findings are in agreement with several authors (Anton *et al.,* 2013; Singh *et al.,* 2003 and Sattar *et al.,* 2007). It was a controlled study in which all the factors including general diet was kept same for both control and treatment group. The single differentiating factor was the micronutrient supplementation in treatment group. It could certainly be possible that the requirement of essential trace mineral was fulfilled by the diet only or may be the requirement of the dual purpose animals is more than cited by the NRC (2001) on the basis of which the formulation of mineral mixture was done.

Table.1 Effect of supplementation of trace minerals and vitamins during transition phase on lactation performance in Deoni primiparous cows

Performance	Mean ± SE		P-value	Significance
	Control	Supplemented		
Average total milk yield/cow (180 days)	529.3[a]±126.3	458.2[a]±101.6	0.6702	NS
Peak yield (L)/cow	5.33[a]±0.94	4.85[a]±0.71	0.6917	NS
Days to peak yield/cow	20.67[a]±6.70	18.83[a]±5.84	0.8407	NS

The values bearing different superscripts in a row differ significantly (P < 0.05)

Table.2 Effect of supplementation of trace minerals and vitamins through transition phase on average milk production (litres) week wise (transition phase) in Deoni primiparous cows

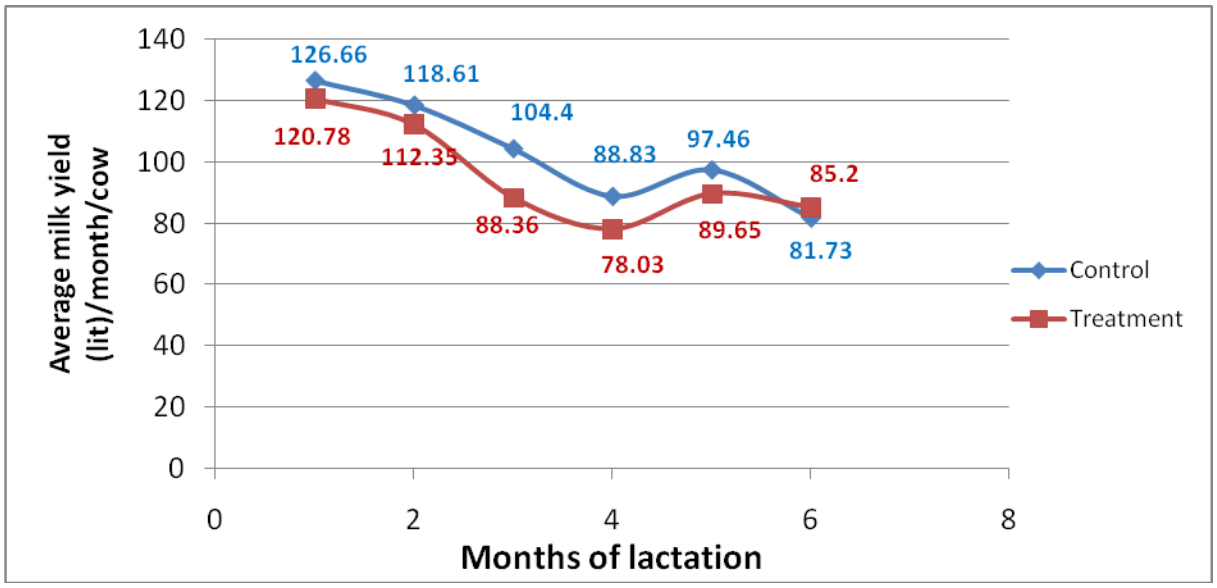
Weeks	Mean ± SE	
	Supplemented	Control
Week-1	27.55[a]±2.8	28.02[a]±2.9
Week-2	28.88[a]±3.9	30.27[a]±4.3
Week-3	29.62[a]±4.6	29.82[a]±4.0

The values bearing different superscripts in a row differ significantly (P < 0.05)

Table.3 Effect of supplementation of trace minerals and vitamins through transition phase on average monthly milk yield (litres) during in Deoni primiparous cows

Months	Mean ± SE	
	Supplemented	Control
1	120.78±16.01	126.66±17.40
2	112.35±14.42	118.61±21.00
3	88.36±16.97	104.4±21.38
4	78.03±20.50	88.83±24.81
5	89.65±5.55	97.46±11.76
6	85.2±13.9	81.73±8.00

Fig.1 Effect of the supplementation of trace minerals and vitamins during transition phase on the monthly milk production pattern (6 months) in primiparous Deoni cows



This difference in the peak milk yield is due to higher milk production by the control cows than the supplemented group, could be because of the more genetic potential and due to the more incidence of inherent short lactation (< 120 days) length problem in supplemented group.

The Deoni breed of cattle is an indigenous dual purpose breed of the Maharashtra and adjoining areas of Karnataka and Andhra Pradesh. This breed is having a normal milk production range of 600-1000 litres per lactation with a very high temperament and immense maternal instinct. According to lactation data of the cattle yard SRS, NDRI, Bangalore, majority (70%) of these animals are prone to short lactation length (< 120 days) with a normal milk yield ranging from 250 to 300 litres per cow and majority of the short lactation sufferers are the primiparous heifers. Being a low to average milk producer, the peak yield and the days to reach to peak yield turned out in a lesser span of time. The primiparous heifers because of their non familiarization with milking procedure and their high temperament, sometimes leads to incomplete milking episodes. During the study it is also observed that the maternal instinct of these animals is so high that even if the calf wasn't allowed to suckle then these animals was prone to withhold the milk in their udder itself. It is also worth to note that, while proceeding for the assessment of the lactation performance in primiparous heifers one should be cautious about the erratic lactation (short lactation) behaviour of the dual purpose Deoni breed.

In conclusions, the transition period is a very crucial time for dairy animals due to various hormonal and metabolic changes in their body for the support of milk production. Generally, adequate minerals and vitamins are provided to animals during transition period for getting a positive impact on subsequent lactation performance. However, when we tried to put in these notions for Deoni heifers (Indigenous Breed) we found that the supplementation of trace minerals and vitamins during transition period did not influence the lactation performances of Deoni primiparous heifers.

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