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# Effect of Pre and Postpartum Alpha-tocopherol Supplementation on Body Condition and Some Udder Health Parameters of Jersey Crossbred Cows at Tropical Lower Gangetic Region

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**ABSTRACT**

Alpha-tocopherol supplementation to dairy cows has beneficial effect on udder health and maintenance of body condition which needs to be studied for Jersey crossbred cows under tropical lower Gangetic region. Survey was conducted on a total of 191 respondents and out of which 19 healthy animals were selected for this experiment. This experiment was done to see the effect of pre and post Alpha-tocopherol supplementation for Jersey crossbred cows @ 1g/day/cow. Three comparable groups viz. T1 (30 days pre and post partum period; 7 dairy cows), T2 (30 days pre and 60 days post partum period; 6 dairy cows), however, no supplementation was done in control group (6 dairy cows) animals. Statistically analyzed data revealed significantly ($p<0.01$) lower body condition in control group than T1 and T2 group animals during post partum period, but T1 and T2 were statistically similar ($p>0.05$). However, animals of group T2 recovered body condition of cows numerically earlier followed by T1 and control group. There was no significant difference between body condition of dairy animals of all group during dry period ($p>0.05$). Statistically analyzed data revealed significantly ($p<0.01$) higher pH and electrical conductivity (EC) in control than T1 and T2 groups during post partum period but T1 and T2 were statistically similar ($p>0.05$). In addition to this correlation coefficient also suggested that better udder health ($p<0.01$) and reduced body condition loss post partum ($p<0.01$) can be achieved by Alpha-tocopherol supplementation @ 1g/day/cow for 30 days pre and 60 days post partum period for Jersey crossbred cows at tropical lower Gangetic region.

**HIGHLIGHTS**

- We studied influence of Alpha-tocopherol supplementation during pre and postpartum period on body condition and udder health of dairy animals.
- A significant ($p<0.01$) effect on postpartum body condition of dairy cows was observed in supplemented groups.
- Electrical conductivity (mS/cm) and pH was significantly ($p<0.01$) improved in supplemented groups.

**Keywords:** Alpha-tocopherol, Body condition, Jersey crossbred, Lower Gangetic region, Udder health

Maintenance of optimal milk production with proper udder health and body condition score of dairy cows is a continuous challenge in tropical type of climatic conditions (Singh *et al*., 2020a; Singh *et al*., 2020b). Tropical climate offers hot and humid conditions which may hamper the body condition and udder health status of dairy cows (Singh *et al.,* 2020c; Bhakat *et al*., 2017). Adoption of good management practices for dairy animals may improve udder health and body condition score in tropical region (Kumari *et al*., 2019; Kumari *et al.*, 2020). During peri- parturition period, cows have less immune response against diseases like mastitis due

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to colostrogenesis and onset of lactation (Smith *et al*., 1997; Mansson *et al.,* 2006). Maintenance of proper udder health and body condition score of dairy animals is a great challenge at tropical regions. Especially for small livestock holders it becomes more crucial (Paul *et al*., 2019). There is remarked loss in body condition and increased risk of udder health problems during dry period and initial lactation period (Berry *et al*., 2007; Singh *et al*., 2020a). Paul and Bhakat (2018) found that under or over conditioned cows at calving have been found to show significantly (P<0.05) increased SCC in milk.

Intra mammary infections in early postpartum period has been found significantly corroborated with body condition score (BCS) in dry period and after calving (Leelahapongsathon *et al.,* 2016). Achieving optimal BCS at calving may prove to be important to avoid ensuing calving, lactation and metabolic disease losses (Mohamm*ed et al.,* 2015; Singh *et al*., 2020a). Vitamin E deficiencies are frequently observed during the periparturient period (Smith *et al*., 1997) which may be one of the causes for sub clinical mastitis. Supplementation of Vitamin E positively affects the functioning of neutrophils and milk quality in organized herd (Politis *et al.,* 2004). Alpha-tocopherol (Vitamin E) supplementation during transition and initial lactation has found positive results on udder health of dairy cows (Chatterjee *et al.,* 2003; Bourne *et al.,* 2008). In addition to this some research suggest positive results for post partum body condition when supplementation of Alpha-tocopherol was done during dry period and initial lactation (Chandra *et al*., 2013; Wathore and Bhakat, 2016). It has been suggested that feeding management of cows should be done in such a way that it can suffice the cow's proper body condition during dry period for better post partum period when there are greater chances of mastitis infection (Faye *et al.,* 1998; Singh *et al*., 2020a).

Studies done to find the effect of pre and post partum supplementation of Alpha-tocopherol on body condition and udder health are very less for tropical type climate of lower Gangetic region for Jersey crossbred cows. Therefore this study was framed to investigate the effect of pre and post partum supplementation of Alphatocopherol on body condition and udder health of crossbred dairy cows at hot-humid region.

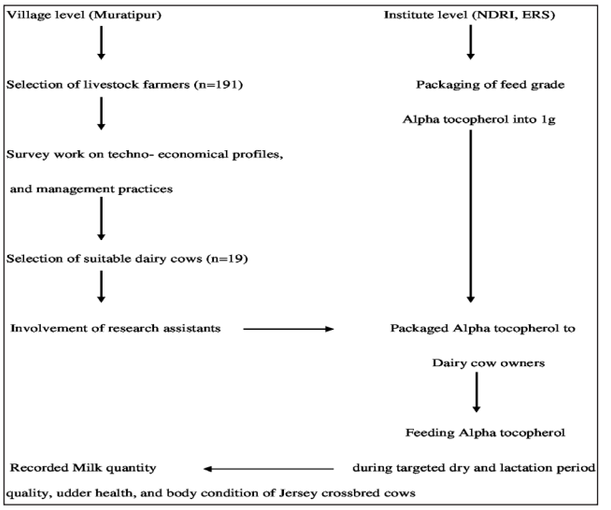
## MATERIALS AND METHODS

### Location of study

The present study was carried out on at ERS-NDRI, institute's adopted village (Muratipur) of Nadia district, West Bengal which has hot humid climate. The latitude and longitude position being 22°56′30″N and 88°32′04″E, respectively.

### Methodology for field experimentation of Alpha-tocopherol

Methodology followed for field experimentation of Alpha-tocopherol was as follows:




### Selection of livestock farmers (n=191)

In Muratipur village of Nadia district, 191 respondents were surveyed who were keeping dairy cows for their livelihood. Most of them were marginal or small farmers with two or three dairy animals. Respondents were surveyed for udder health management practices which are represented in table (1) and management practices as shown in table (2) followed by dairy farmers.

### Selection of suitable dairy cows (n=19)

Out of 191 surveyed respondents, dairy cows (n=19) of different farmers which were in last trimester of gestation were selected for field experimentation based on their

**Table 1:** Udder health management practices followed by respondents

| Management practices | | Level of adoption (%) | | |
|---|---|---|---|---|
| **Grazing allowed** | **Occasionally** | **66** | **Daily** | **34** |
| Grooming done | No | 28 | Yes | 72 |
| Drying of hands before milking | No | 81 | Yes | 19 |
| Drying of teats and udder before milking | No | 74 | Yes | 26 |
| Post Dip after milking | No | 77 | Yes | 23 |
| Post milking standing period is practiced | No | 71 | Yes | 29 |
| Drying off method practiced | No | 85 | Yes | 15 |
| Knowledge about sub clinical mastitis | No | 92 | Yes | 18 |
| History of clinical mastitis to the cattle | No | 75 | Yes | 25 |

**Table 2:** Management practices followed by respondents

| Management practices | | | Level of adoption (%) | | | |
|---|---|---|---|---|---|---|
| Cleanliness | Poor | 34 | Fair | 52 | Good | 14 |
| Frequency of cleaning | Weekly | 34 | Once daily | 52 | Twice daily | 14 |
| Use of disinfectant for cleaning | No | 60 | Yes | 40 | | |
| Shed floor | Muddy | 17 | Brick Floor | 34 | Cemented Floor | 13 |
| Proper drainage system | No | 66 | Yes 36 | | | |
| Roof material | Straw & Plastic | 45 | Wood & plastic | 45 | Asbestos sheet straws | 10 |
| Wall of shed | Kuccha | 64 | Brick | 30 | Cemented | 6 |
| Manger | Kuccha | 67 | Pucca | 33 | | |
| Separate water trough | No | 62 | Yes | 38 | | |
| Animal washing | Once daily | 68 | Twice daily | 30 | Irregular | 2 |

parity, level of production, BCS, age and body weight. Keeping in mind, the poor economic background of dairy farmers, Alpha-tocopherol of feed grade was procured (₹ 1.4/ gram) for supplementing @ 1 g/d/cow to those selected cows from 30 days pre to 60 days post partum period in two different treatment groups than control group. Surveyed milk samples reflected poor udder health. pH was higher (>6.8) and electrical conductivity (EC) was (>5.57mS/cm) in subclinical mastitic milk samples. Batavani *et al.* (2007) and Boas *et al*. (2016) stated that these conditions to be the indicative tests of subclinical mastitis case. Furthermore, Norberg *et al.* (2004) suggested EC to be effective parameter for predicting udder health status of dairy cows. In addition to this, animals were in poor body condition (<3 BCS) on 1 to 6 scale (Singh and Kumari, 2019)

## Involvement of research assistants

Competent and trained research assistants used to supply the pre packaged 1 g Alpha-tocopherol to the selected dairy cows during the targeted days of dry as well as lactation period to feed them. Following which the udder health parameters were measured in the NDRI- ERS, Livestock Production Management section (LPM section) laboratory under aseptic conditions and body condition scores were measured on fortnight basis. However, these fortnight evaluations were utilized for parameters on monthly basis.

## Experimental animals and Alphatocopherol supplementation

This experimentation was conducted during the year 2018 to 2019 on 19 Jersey crossbred cows having similar initial body condition score (BCS), body weight and parity and observations were taken during dry period (30 days pre calving), during calving and post-partum up to 5 months of lactation period. Based on BCS and body weight during drying off time (after completion of full lactation) animals were randomly divided into 3 different comparable group i.e. group-1 as T1 and group-2 as T2 and control group. T1 comprised 7 animals supplemented with Alphatocopherol @ 1 g/ cow/ day for 30 days pre- partum and 30 days post- partum period; In T2, 6 cows were supplemented

with Alpha-tocopherol @ 1 g/ cow/ day for 30 days pre-partum and 60 days post- partum period, and in control group traditional feeding management was done without Alphatocopherol supplementation. Chatterjee *et al.* (2004) suggested a dose of 1000 IU/cow/day to be used in dairy animal feeding 30 days before and 30 days after calving. Farmers of this region are mostly small and marginal (Garai *et al*., 2017), keeping in view of this situation we procured Alpha-tocopherol @ ₹ 1.4/g to be fed to the dairy cows of farmers to which they can afford. Vitamin E dry powder (α-Tocopheryl acetate 50%, containing 500mg Vitamin E acetate per gram) manufactured by MERCK Limited, Usgaon, Ponda, Goa- 403407 was used in this experiment. Alpha-tocopherol was added to concentrate mixture pre-partum and during milking time to make sure that the animals had received complete amount of Alphatocopherol.

All groups of animals were provided (traditional feeding management practice) with a*d libitum* green and dry fodders during dry period. During postpartum period provided with concentrate mixture (@3 kg/cow/day) as a part of management practice along with a*d libitum* green and dry fodders. The DCP and TDN contents of concentrate mixture were 14 % and 68 % respectively. Animals were stall fed with provision of separate manger and watering facility (Singh *et al*., 2020e). However, all animals were observed as apparently healthy before and during the conduct of field trial. Housing and other management practices were similar to all groups.

### Body condition score

Body condition score (BCS) of animals were assigned using visual plus palpation technique. This method grades the status of cow's body condition on a six-point scale (1-6). The score 1 reflects very thin and 6 reflects very fat condition of the animal. For assessing the body condition of animals, anatomical regions (critical points) were taken into account meticulously as standardized (ultra-sonography method) by Paul *et al.* (2019) for Jersey crossbred dairy cows of tropical lower Gangetic region.

### Udder health in terms of pH and EC

From every animal, about 70 ml of milk samples were collected from whole milk bucket after complete milking of individual animals in sterilized glass bottles at fortnight intervals. Udder health status (sub-clinical mastitis) was detected by EC and pH of milk samples as per the method followed by (Singh *et al*., 2020a).

## STATISTICAL ANALYSIS

All data were meticulously analyzed by IBM SPSS statistics 21 software for statistical analysis. BCS and udder health parameters were analysed by using the univariate General Linear Model (GLM) method for analysis of variance. It was followed by means comparisons for all pairs using Duncan's New Multiple Range Test (DMRT). The correlation coefficients were determined as per Pearson's correlation method. The significant differences were set at $P < 0.05$ and $P < 0.01$.

## RESULTS AND DISCUSSION

### Body condition score

Overall difference between the mean BCS as shown in table (3) and graphically shown in figure (1) during dry period in control, T1 and T2 groups was found non-significant. However, there was significantly ($p<0.01$) marked difference between control and treatment groups but, T1 and T2 groups differed non significantly after 5 months of lactation period. There was trend of reduction in the body condition of cows, post calving, of each group but, loss in body condition was more pronounced and sharp in control group as compared to treatment groups. Similar pattern of reduction in BCS during initial lactation period was shown by Singh *et al.* (2020a). This may be due to the inability of control group animals to cope with maintenance and lactation needs of alpha tocopherol. However, the mechanism behind this is a researchable issue. Increased incidence of health problems arises in dairy cattle as a consequence of accelerated BCS drop during the transition period (Kim and Suh, 2003). More body loss and body condition loss leading to negative energy balance post partum are known to reveal adverse effects in high milk yielders (Cutullic, 2010; Friggens *et al.,* 2007). Vitamin E deficiencies are frequently observed during the periparturient period (Smith *et al*., 1997; Singh *et al*., 2020f) which may be one of the causes for sub clinical mastitis. Decreased body condition loss during lactation period from optimum range reflects negative

energy balance of dairy animals as shown by lesser production of milk and also the milk quality is reduced. Supplementation of Vitamin E at > 1000 IU/ day during the dry period of dairy cow was found to reduce the cases of mastitis (Weiss *et al.,* 1997).

**Table 3:** LSQ mean ± S.E of BCS in Jersey crossbred cows

| Months (M) | Control | T1 | T2 | Overall |
|---|---|---|---|---|
| 1st M of DP | 3.38[a]±0.07 | 3.43 [a]±0.05 | 3.38 [a]±0.09 | 3.39±0.07 |
| 2nd M of DP | 3.67 [a]±0.08 | 3.68 [a]±0.09 | 3.83 [a]±0.06 | 3.73±0.08 |
| Overall DP | 3.52 [a]±0.05 | 3.55 [a]±0.07 | 3.60 [a]±0.08 | 3.56±0.07 |
| 1st M of LP | 3.83 [a]±0.07 | 3.96 [a]±0.06 | 4.00 [a]±0.09 | 3.93±0.07 |
| 2nd M of LP | 3.50 [a]±0.08 | 3.75 [a]±0.07 | 3.58 [a]±0.11 | 3.61±0.09 |
| 3rd M of LP | 3.17 [a]±0.06 | 3.32 [a]±0.09 | 3.25 [a]±0.08 | 3.25±0.08 |
| 4th M of LP | 2.83 [a]±0.09 | 3.32 [b]±0.10 | 3.42 [b]±0.06 | 3.19±0.08 |
| 5th M of LP | 2.75 [a]±0.05 | 3.46 [b]±0.04 | 3.54 [b]±0.05 | 3.25±0.05 |
| Overall LP | 3.22 [a]±0.07 | 3.56 [b]±0.07 | 3.56 [b]±0.08 | 3.45±0.07 |

Means with different superscripts differ significantly (P < 0.01) from each other row wise.

## Udder health

### pH

Table (4) represents the mean of pH of milk samples of control, T1, and T2 groups. Overall means of pH of milk samples of 5 months of lactation period in all three groups differ significantly (p<0.01). However, T1 and T2 group means differed non-significantly. pH of milk in samples of control group was highest which reflects its poor quality. It was remarked by Batavani *et al.* (2007) that the pH was higher in SCM milk as compared to normal milk. Also it was showed by Ikonen *et al.* (2004) that the genetic correlation among milk pH and somatic cell count was high. Vitamin E @ 1000 IU/ day/ cow supplemented at least 30 days prepartum to 30 days post-partum was found to reduce the incidence of mastitis and had beneficial effect on milk yield (Chatterjee *et al*., 2003). Also, 4000 IU Vitamin E supplementation during last 14 days of dry period was found to improve udder health (Politis *et al.,* 2004); it was reported that supplementation of 3,000 IU of vitamin E 8 wk prepartum to 2 wk post- calving reduced oxidative damage to the liver (Bouwstra *et al.,* 2008) also, (Politis *et al.,* 2012) suggested that 3000 IU vitamin E should be supplemented during late dry period of dairy cows.

### Electrical Conductivity (mS/cm)

Electrical conductivity (EC) in milk samples of control, T1, and T2 groups are shown in table (4). Overall mean of electrical conductivity in milk samples of control, T1, and T2 groups were found significantly different (p<0.01) between control and treatment groups for 5 months lactation period. However, there was non-significant difference between the overall means of T1 and T2 groups. Electrical conductivity in milk samples of control group was highest which reflects its poor quality. Kansal *et al.* (2020) suggested EC test suitable for determining subclinical mastitis in milk of dairy cows. Boas *et al.* (2016) suggested that electrical conductivity trait of milk may be used as a criterion for selection of mastitis resistant animals in addition with somatic cell count. Electrical conductivity range of normal milk is between 4.0 to 5.86 mS/cm (Norberg *et al.,* 2004) however, Norberg *et al.* (2004) also found that the milk samples which had electrical conductivity 5.37 mS/cm or more were found sub clinically mastitic. Boas *et al.* (2016) found mean electrical conductivity of milk in Gir cows to be 4.90 mS/cm that had corresponding SCC as 316,017 ± 66,896 cells/ml.

**Table 4:** LSQ Mean ± S.E of pH in milk samples of Jersey crossbred cows

| Months | Control | T1 | T2 | Overall |
|---|---|---|---|---|
| 1 | 6.75 [a]±0.06 | 6.53 [b]±0.02 | 6.51 [b]±0.04 | 6.60±0.03 |
| 2 | 6.97 [a]±0.03 | 6.55 [b]±0.03 | 6.55 [b]±0.02 | 6.69±0.03 |
| 3 | 7.00 [a]±0.05 | 6.53 [b]±0.03 | 6.58 [b]±0.06 | 6.70±0.05 |
| 4 | 7.08 [a]±0.02 | 6.56 [b]±0.06 | 6.54 [b]±0.08 | 6.73±0.05 |
| 5 | 7.14 [a]±0.04 | 6.59 [b]±0.04 | 6.52 [b]±0.03 | 6.75±0.04 |
| Overall | 6.99 [a]±0.04 | 6.55 [b]±0.04 | 6.54 [b]±0.05 | 6.69±0.04 |

Means with different superscripts differ significantly (P < 0.01) from each other row wise.

### Correlation

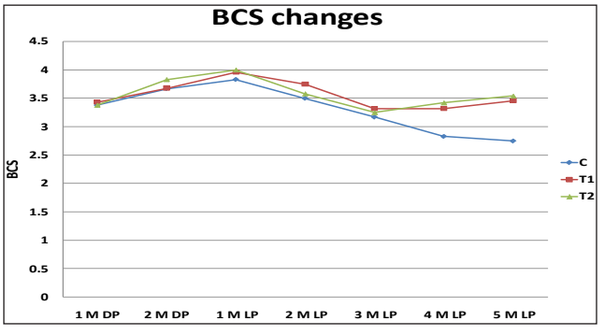
Investigation of coefficients of correlation indicated a negative and significant (P<0.01) correlation between BCS & pH (-0.533), BCS & EC (-0.462), BCS & MCMT (-0.295). Correlation coefficients of present study

suggested positive and significant ($p<0.01$) correlation between BCS and Milk yield (MY) (0.387) and negatively significant ($p<0.01$) correlation between BCS and Somatic cell count (SCC) (-0.409). The correlations suggest that Jersey crossbred cows with comparatively higher BCS than significantly more decreased BCS during initial lactation period have better udder health and milk yield. Outcomes from correlation of this study are in line with the findings of earlier studies (Chatterjee *et al.,* 2003; Bourne *et al.,* 2008; Leelahapongsathon *et al.,* 2016; Paul and Bhakat, 2018; Singh *et al*., 2020a; Singh *et al*., 2020b; Singh *et al*., 2020d).

**Table 5:** LSQ Mean ± S.E of Electrical conductivity (mS/cm) in milk samples of Jersey crossbred cows

| Months | Control | T1 | T2 | Overall |
|---|---|---|---|---|
| 1 | 5.95 $^{a}$±0.12 | 4.39 $^{b}$±0.16 | 4.41 $^{b}$±0.17 | 4.92±0.15 |
| 2 | 5.95 $^{a}$±0.11 | 4.43 $^{b}$±0.18 | 4.43 $^{b}$±0.22 | 4.94±0.17 |
| 3 | 6.11 $^{a}$±0.17 | 4.49 $^{b}$±0.19 | 4.37 $^{b}$±0.20 | 4.99±0.19 |
| 4 | 6.34 $^{a}$±0.14 | 4.42 $^{b}$±0.10 | 4.44 $^{b}$±0.19 | 5.07±0.14 |
| 5 | 6.46 $^{a}$±0.14 | 4.54 $^{b}$±0.11 | 4.47 $^{b}$±0.17 | 5.16±0.14 |
| Overall | 6.16 $^{a}$±0.14 | 4.46 $^{b}$±0.15 | 4.42 $^{b}$±0.19 | 5.01±0.16 |

Means with different superscripts differ significantly ($P < 0.01$) from each other row wise.




*M = month; DP = dry period; LP = lactation period

**Fig. 1:** Month wise BCS variation of Jersey crossbred cows at Tropical climate

## CONCLUSION

It can be concluded that supplementation of Alphatocopherol @ 1g/day/cow for 30 days pre partum and 60 days post partum period may be effective to maintain and improve body condition during early lactation period and udder health of dairy crossbred cows at tropical lower Gangetic region.

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