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Economic Analysis of Pre and Postpartum Alphatocopherol Supplementation for Milk Performance and Dry Matter Intake of Dairy Cows in Tropical Region

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Abstract

Proper management during transition period and initial lactation period is crucial for overall lactation production performances of dairy animals. Alphatocopherol (Vitamin E) supplementation has showed better results in dairy cows as expressed in different studies. This experiment was done to see the effect of pre and postpartum Alphatocopherol supplementation for Jersey crossbred cows @ 1g/day/cow. Survey was conducted on a total of 191 respondents and out of which 19 suitable and healthy animals were selected for this experiment. Suitable 19 healthy milch Jersey crossbred cows which were separated into three comparable groups viz. control, T1 and T2. Treatment groups viz. T1 (n=7), T2 (n=6) were supplemented with Alphatocopherol as compared to control group C (n=6) during dry period and initial lactation period respectively. Statistically analyzed data showed significantly no difference (P>0.05) dry matter intake during dry period and during initial 60 days of lactation period. Economic analysis was done to access the efficiency of utilizing Alphatocopherol during dry and initial lactation period in dairy cows of tropical region. Profit earned as a result of Alphatocopherol in T1 group was 2.36 times and 2.88 times more in T2 group animals as compared to control group animals. In conclusion it can be stated that the supplementation of Alphatocopherol can improve the production performance of dairy cows economically during initial lactation period of dairy cows at tropical region.

Keywords: Alphatocopherol, Dairy Cows, Dry Matter Intake, Economics, Tropical Region

Introduction

Improved milk production, high quality, health and the economics of dairy farm is always on the top priority of any dairyman (Singh *et al*., 2020a). Maintenance of enhanced quantity and quality milk production with proper animal health is a continuous challenge for a dairy owner (Singh *et al*., 2020b). In order to maintain proper production with animal health of animals a dairyman has to effectively and economically run the farm operations (Singh and Roy, 2018). Adoption of improved management practices have shown improved performance of dairy animals (Kumari *et al*., 2020).

Dairy animals are exposed to several production, metabolic and immunity stress during transition and initial lactation period (Berry *et al*., 2007; Singh *et al*., 2020b). It has been generally observed that the dry matter intake gets drastically reduced during transition period and initial lactation period (Bewley *et al*. 2008; Kuhla *et al*. 2015; Kuhla *et al*. 2016; Singh *et al*., 2020b). 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*., 2020b). 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; Singh *et al*., 2020c). Management of dairy animals, especially, during transition period and initial lactation period has a high influence on overall lactation performance (Mansson *et al*. 2006; Berry *et al*., 2007; Ivemeyer *et al*., 2009; Singh *et al*., 2020c). Tropical region offers harsh climatic conditions for dairy animals (Singh *et al*., 2020e). Availability of good quality fodder in this region is one of the major challenges for this area (Singh *et al*., 2020b). Recent researches have shown high potential of Alphatocopherol supplementation for the improvement in production performance and health maintenance of dairy animals economically (Politis *et al.,* 2004; Singh *et al*., 2020c; Kansal *et al*., 2020; Kumari *et al*., 2019). Recent studies have shown that overall immunity status of dairy cows is challenged during transition period (Leelahapongsathon *et al.,* 2016). Vitamin E supplementation during this period has been found to significantly improve immunity status of dairy cows (Smith *et al*., 1997; Chatterjee *et al*., 2003; Spears and Weiss, 2008). In addition to boosting immunity status Vitamin E supplementation has been shown to enhance milk yield (Al-Mabruk *et al.,* 2004; Pottier *et al.,* 2006; Martinez *et al*., 2009; Oelker *et al*., 2009; Fatahnia *et al*., 2010; Khodamoradi *et al*., 2012; Singh *et al*., 2020c), milk quality (Fatahnia *et al.,* 2010), udder health (Pottier *et al*., 2006), reproduction status (Wilde, 2006) and body condition of dairy animals (Singh *et al*., 2020c). There is a continuous demand for efficient and cost-effective management strategies for enhanced production performance. To the knowledge of authors there are very less or no literature present in the field of animal husbandry regarding economical analysis of Alphatocopherol supplementation in diary animals. Therefore, an economic evaluation of Alphatocopherol supplementation in dairy cows was done to observe the efficiency of using it in dairy animals. Assessment was done to see the effect of Alphatocopherol supplementation on dry matter intake of dairy cows.

Materials and Methods

This study was conducted in the adopted village Muratipur of city Kalyani, West Bengal, India. Geographical coordinates being 22°58′30″N88°26′04″E.

Methodology for Field Experimentation of Alphatocopherol

Details of the animals were referred from records of Infrastructure named Dairy Vikas Kendra in the adopted village Muratipur of ERS, NDRI, Kalyani, West Bengal, India. Farmers regularly visit Dairy Vikas Kendra for regular health checkups of their animals, timely insemination, and different training programmes. Two level methodologies were followed for field experimentation. At Institutional level, decision of suitable farmers based on survey data was done followed by procuring and packaging of Alphatocopherol was done. On the other hand, at village level, the survey of 191 respondents was done to identify the suitable farmers for this study was done, then packaged Alphatocopherol was provide, regular data for study parameters was done at specific intervals.

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 and general farm management practices. Survey results showed that almost all the farmers practiced very poor udder health management practices.

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 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 (Rs. 1.4/ gram) for supplementing @ 1g/d/cow to those selected cows from 30 days pre to 60 days post-partum period in two different treatment groups than control group.

Involvement of Research Assistants

Competent and trained research assistants used to supply the prepackaged 1g 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

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 observed during dry period (30 days pre calving), during calving and post-partum up to 5 months of lactation period. Based on BCS, parity, level of production in previous lactation 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@ 1g/ cow/ day for 30 days pre- partum and 30 days post- partum period; In T2, 6 cows were supplemented with Alphatocopherol@ 1g/ 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.

Feeding and Housing Management of Dairy Animals

All groups of animals were provided (traditional feeding management practice) with good quality *ad libitum* green and dry fodders during dry period. During postpartum period provided with concentrate mixture (@3 kg/cow/day) along with *ad libitum* good quality green and dry fodders. The DCP and TDN contents of concentrate mixture were 14 % and 68 % respectively. However, animals were apparently healthy without any kind of disorders. Housing and other management practices were similar to all groups. Animals were stall fed with provision of separate manger and watering facility. Fresh and good quality green and dry fodder was used for feeding to the dairy animals.

Similar housing management was found similar for all three groups of dairy animals. Each and every dairy animal was kept under stall fed conditions. Separate feeding manger and watering facility was provided to all the animals (Singh *et al*., 2020f). Floor in animal house was made of paved concrete type however separate paddy materials were provided for cushioning near parturition period to avoid any physical injury (Mishra *et al*., 2017; Singh *et al*., 2020d). Trained veterinary person was allotted for regular health check of dairy cows. Weaning at birth was followed in both the groups. During winter season each farm floor surface was provided with paddy straw for dryness and warmth maintenance. Each and every animal of every group was hand milked twice a day (6:00 Am) in the morning and (7:00 Pm) during evening time. Following which the milk data for individual cow was recorded.

Dry Matter Intake (DMI)

During dry period animal's feed intake (individual feeding) of concentrate mixture and fodder (green & dry) was measured every day with the help of an electronic weighing balance with a least count of 50g. DMI through concentrate and fodder (green+dry) was estimated daily during dry period. Dry matter through fodder was determined by taking a composite mixture sample of fodder followed by drying it into an oven at 38ºC for 48 hours

in hot air oven. Using weighing balance, the estimation of dry matter of both the dry and green fodders was done. This dry matter was then added to the dry matter of concentrate mixture to obtain total dry matter intake through concentrate and fodder. This made the estimation of total DMI.

Economic Analysis of the Alphatocopherol Supplementation

Following parameters were taken into consideration for economic evaluation of Alphatocopherol during different physiological stages of dairy animals:

1. Cost of Alphatocopherol
2. Cost of feed offered to the animal under different groups
3. Average daily cost (Rs) per animal/day
4. Average milk yield/day/cow
5. Cost of per kg milk yield
6. Total selling price/day/cow
7. Benefit from milk increment Rs/animal/day (@ Rs. 30/kg milk)
8. Ratio of profit in different treatment group than control group

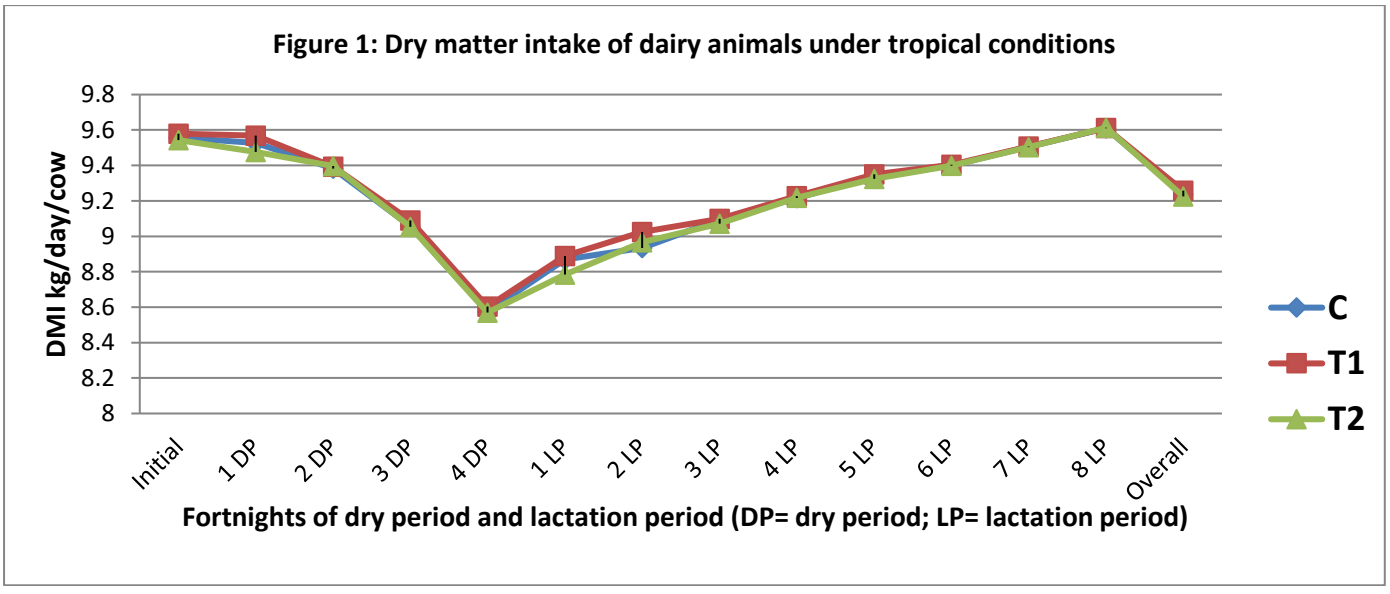
Statistical Analysis

Each and every parameters of this study was meticulously analyzed using IBM SPSS statistics 22 software package. Duncan's multiple range tests was performed for accessing significance of difference under different treatment and control group animals wherever necessary. Excel 2007 software of Microsoft Co. was used for data recording and graphical interpretation was also done with the help of Excel 2007 software.

Results and Discussion

Dry Matter Intake

Analyzed set of data for DMI for different groups of dairy animals has been presented in Fig. 1. Stringent statistical analysis showed that the DMI in treatment group animals were significantly non different (P>0.05) as compared to control group animals for overall lactation period.



Initial and overall DMI in all groups were observed statistically similar. More depression in DMI was seen in animals of control group as compared to treatment group. There was a sharp decline in DMI in all groups during last fortnight of dry period and first two fortnights under all groups. However, there was gradual rise in DMI under all different groups.The depressions in DMI of this study are in line with the observations of a latest study by Singh *et al*. (2020).Results of this study is consistent with the findings of earlier researches (Al-Mabruk *et al.*, 2004; Pottier

et al., 2006; Martinez *et al.,* 2009; Oelker *et al.,* 2009; Fatahnia *et al.,* 2010; Khodamoradi *et al*., 2012) who also observed that supplementation of Alphatocopherol to the dairy cows had no significant effect on dry matter intake.

Economic Analysis

Market cost for various inputs was considered for the period when the study was conducted. Economics of Alphatocopherol supplementation (Table 1) was calculated. Following variables were taken into consideration for analysis:

1. Cost of Alphatocopherol

= Rs. 14000 for 10 Kg
= Rs. 1.4/gm Alphatocopherol

2. Cost of feed offered to the animal

Cost of concentrate intake (3kg/cow/day @ Rs. 26/kg) = Rs.78/cow
Cost of dry matter offered through green and dry fodder = Rs. 130/cow
Total cost of feeding= Rs. (78+130) = Rs. 208

3. Cost of feeding in T1 group

= 60 days*Alphatocopherol treatment + 120 days*Daily feeding cost
= 60 (1.4+208) + 120*208
= Rs. (12, 564 + 24, 960) = Rs. 37, 524
= Rs.208.5/cow/day

4. Cost of feeding in T2 group

= 90 days*Alphatocopherol treatment + 90 days*Daily feeding cost
= 90 (1.4+208) + 90*208
= Rs. (18, 846 + 18, 720) = Rs. 37, 566
= Rs. 228.7/cow/day

Table 1: Economics of additional milk produced by experimental animals in different groups

S. No.	Management Practices	Avg daily cost (Rs) per animal/day	Avg milk yield/day/ cow	Cost of per kg milk yield	Selling price/day	Benefit from milk increment Rs/animal/day (@ Rs. 30/kg milk)	Ratio of profit than Practice-I
1	Control	208	7.88	26.39	236.4	28.4	-
2	T1 group	208.5	9.19	22.69	275.7	67.2	2.36
3	T2 group	208.7	9.68	21.55	290.4	81.7	2.88

Conclusion

This study revealed that Alphatocopherol supplementation has high potential for improving the profitability of dairy farmers especially small-scale dairy owners. Statistical analysis expressed that although the dry matter intake among different groups were statistically similar but, there was improved milk performance of dairy cows under treatment groups than control group cows. Economic evaluations suggested that there was improved cash flow of profit for treatment group cows as compared to that of control group animals. In terms of profit, treatment group T2 performed better than group T1 followed by control group. In conclusion it can be remarked that supplementation of Alphatocopherol @ 1g/day/cow 30 days before and 60 days after parturition is profitable for dairy owners of tropical region. Dairy owners can make better profitability by the supplementation of Alphatocopherol to dairy cows of hot and humid region.

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Conflict of Interests

There is no conflict of interest.

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