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Effect of pre and post-partum Alphatocopherol supplementation on body measurements and its relationship with body condition, milk yield, and udder health of Jersey crossbred cows at tropical lower Gangetic region

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Abstract
To find out the effect of Alphatocopherol supplementation an experiment was carried out on Jersey crossbred cows at lower Gangetic region. Three groups were taken *viz*. C (without any supplementation), T1 (Alphatocopherol supplemented @ 1g/cow/day 30 days before and after calving) and T2 (Alphatocopherol supplemented @ 1g/cow/day 30 days before and 60 days after calving) and the effect of Alphatocopherol supplementation was seen for body measurements. Statistically analyzed data revealed that THT (cm) (tail head thickness) was T1 and T2 had significantly (P<0.01) higher than C however, T1 and T2 were statistically similar. Significantly (P<0.01) higher body length (cm) was observed in T2 followed by T1 and C groups. Significantly (P<0.01) higher abdominal girth (cm) was found in T2 followed by T1 and C group however, T1 and C were statistically similar. Heart girth (cm) was found statistically similar (P>0.05). Correlation coefficients suggested that THT may be one of the very helpful tools to monitor BCS, milk yield and udder health of dairy cows. It can be concluded that Supplementation of pre and post-partum Alphatocopherol affects tail head thickness, body length, and abdominal girth of Jersey crossbred cows at tropical lower Gangetic region.

Keywords: Alphatocopherol, Jersey crossbred, body measurements, milk yield, udder health

Introduction
High and economical milk producing cows are always on great demand. Milk producing ability of dairy cow with good quality and better udder health should be considered important during selection of cows. Estimation of body measurements has been remarked important by many researchers (Bayram *et al.*, 2006) [1]. More body loss and body condition loss leads to a significant negative energy balance during initial lactation period which are known to reflect adverse effects in high producing cows (Friggens *et al.*, 2007; Cutullic *et al.*, 2010) [7, 5]. It is quite common trend during dry period for a dairy cow in which it loses its body condition as she approaches to parturition (Roche *et al.*, 2009) [13]. Slight loss of body weight during 30 days postpartum is commonly seen in high-yielders (Doepel *et al.*, 2002) [6]. Relationship between body measurements and total milk yield has been found inconsistent by other research workers (Moore *et al.*, 1991; Bayram *et al.*, 2006) [9, 1]. The previously done studies revealed the potential of estimation of body measurements with their relationships with milk quantity, milk quality.
Therefore the present study aims to study the influence of alteration of dry period feeding management body measurements of Jersey cross bred cows. Attempt has been made to see the effect of vitamin E supplementation over some important body measurements. In addition to this, correlation of parameters like THT with BCS, total milk yield, and udder health in terms of SCC, MCMT, pH, EC have also been studied.

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.

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 observed 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@ 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.

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) along with a*d libitum* green and dry fodders. The DCP and TDN contents of concentrate mixture were 14% and 68% respectively. However animals were free from all kind of physiological, anatomical and infectious disorders. Housing and other management practices were similar to all groups.

Body Measurements

Following body measurements were taken on every fortnight and time described earlier in case of body weight measurement using a measuring tape and measuring stand (Paul and Bhakat, 2018).

- **Heart girth (HG):** Heart girth measurements were taken as the circumference of the thorax just behind the point of elbow.
- **Abdominal girth (AG):** The circumference over the abdomen just behind the posterior border of the last rib and in front of the umbilicus.
- **Tail thickness at base (TTH):** TTH was taken as the thickness of the tail near the point of its attachment with the vertebral column.
- **Body Length**: Body length was measured from point of shoulder to point-of-rump or pin bone.

Results and Discussion

Body measurements (cm)

Body measurements had been done in terms of heart girth (HG), abdominal girth (AG), and tail head thickness (THT) of Jersey crossbred cows are presented in the respected tables.

Tail head thickness (cm)

Means of tail head thickness of cows of all three groups are presented in table (1). There was significantly ($p<0.01$) marked difference between control and treatment groups but, T1 and T2 groups differed non significantly during dry period and after 5 months of lactation period. This may be as a result of the better ability of animals of treatment groups to retain body reserves as an effect of alpha tocopherol supplementation as compared to control group animals. Treatment group animals with higher BCS had higher THT as compared to control group animals. Similar results were found by Prasad (1994) that THT is corroborated with BCS. This difference was found may be due to more subcutaneous fat reserve in body tissue of animals.

Correlation coefficients showed highly significant (*P<0.01*) and positive correlation among THT & BCS (+0.629), THT & Milk yield (+0.488). Highly significant (*P<0.01*) and negative correlation was observed among THT & SCC (somatic cell count) (- 0.452), THT & MCMT (-0.485), THT & pH (-0.562), THT & EC (Electrical conductivity) (-0.528). The above correlation coefficients suggest that more THT reflects more BCS with more milk yield in this study. However, as the THT becomes higher the milk SCC, MCMT, pH, EC lessens which is desirable. The result so obtained may be due to the fact as THT directly reflects body condition, and as body condition is in good condition the milk SCC, MCMT, pH, EC comes to the normal levels which is desirable in milk.

Table 1: LSQ mean ± S.E of tail head thickness (cm) in Jersey crossbred cows

Months (M)	C	T1	T2	Overall
1st M of DP	$9.63^{a} \pm 0.15$	$10.19^{b} \pm 0.11$	$10.22^{b} \pm 0.07$	10.01 ± 0.11
2nd M of DP	$10.09^{a} \pm 0.12$	$10.76^{b} \pm 0.16$	$10.70^{b} \pm 0.12$	10.52 ± 0.13
Overall DP	$9.86^{a} \pm 0.14$	$10.47^{b} \pm 0.14$	$10.46^{b} \pm 0.10$	10.26 ± 0.13
1st M of LP	$10.27^{a} \pm 0.16$	$11.07^{b} \pm 0.12$	$11.00^{b} \pm 0.08$	10.78 ± 0.12
2nd M of LP	$9.76^{a} \pm 0.14$	$10.60^{b} \pm 0.10$	$10.62^{b} \pm 0.11$	10.33 ± 0.12
3rd M of LP	$9.42^{a} \pm 0.11$	$10.13^{b} \pm 0.18$	$10.18^{b} \pm 0.13$	9.91 ± 0.14
4th M of LP	$9.01^{a} \pm 0.18$	$9.64^{b} \pm 0.12$	$9.78^{b} \pm 0.16$	9.48 ± 0.15
5th M of LP	$8.63^{a} \pm 0.15$	$9.40^{b} \pm 0.11$	$9.54^{b} \pm 0.18$	9.19 ± 0.15
Overall LP	$9.42^{a} \pm 0.15$	$10.17^{b} \pm 0.13$	$10.23^{b} \pm 0.13$	9.94 ± 0.14

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

Body length (cm)

Means of body lengths of cows of all three groups during precalving and 5 months of lactation period has been depicted in table (2). There was significant difference ($p<0.01$) amongst overall means of all three groups before and after 5 months of calving this may be due to more subcutaneous fat deposited over rump region of cows.

Table 2: LSQ mean ± S.E of body length (cm) in Jersey crossbred cows

Months (M)	Control	T1	T2	Overall
1st M of DP	137.17 a ± 1.16	139.29 b ± 1.03	143.92 c ± 1.02	140.12 ± 1.07
2nd M of DP	137.88 a ± 1.14	140.36 b ± 1.06	145.42 c ± 1.14	141.22 ± 1.11
Overall DP	137.52 a ± 1.15	139.82 b ± 1.05	144.67 c ± 1.08	140.67 ± 1.09
1st M of LP	138.08 a ± 1.24	140.57 b ± 1.11	145.71 c ± 1.05	141.45 ± 1.13
2nd M of LP	136.96 a ± 1.15	139.50 b ± 1.07	144.42 c ± 1.13	140.29 ± 1.12
3rd M of LP	136.33 a ± 1.19	138.68 b ± 1.21	143.33 c ± 1.17	139.45 ± 1.19
4th M of LP	135.96 a ± 1.12	138.18 b ± 1.17	142.17 c ± 1.14	138.77 ± 1.14
5th M of LP	135.71 a ± 1.11	137.75 b ± 1.22	141.42 c ± 1.19	138.29 ± 1.17
Overall LP	136.61 a ± 1.16	138.94 b ± 1.16	143.41 c ± 1.14	139.65 ± 1.15

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

Heart girth (cm)

Mean heart girth of animals are shown in table (3) during dry period and after calving period of 5 months. There was no significant difference amongst control, T1, and T2 groups during pre calving and after calving. However, HG of control and treatment groups was statistically non- significant, but comparatively more in treatment group animals. Hence, high HG was observed in more BCS animals and low HG in animals with low BCS. Similar result was investigated by Otto *et al.* (1991) [10], Prasad *et al*. (1994) [11] and Gallao *et al.* (2001), who had noticed strong correlation between HG and BCS.

Table 3: LSQ mean ± S.E of heart girth (cm) in Jersey crossbred cows

Months (M)	C	T1	T2	Overall
1st M of DP	170.75 a ± 0.71	171.29 a ± 0.80	172.54 a ± 0.72	171.53 ± 0.74
2nd M of DP	169.67 a ± 0.77	170.29 a ± 0.70	171.38 a ± 0.75	170.44 ± 0.74
Overall DP	170.21 a ± 0.74	170.79 a ± 0.75	171.96 a ± 0.74	170.98 ± 0.74
1st M of LP	168.71 a ± 0.58	168.86 a ± 0.75	169.92 a ± 0.64	169.16 ± 0.66
2nd M of LP	168.00 a ± 0.67	167.86 a ± 0.62	168.79 a ± 0.62	168.22 ± 0.64
3rd M of LP	167.33 a ± 0.61	167.14 a ± 0.68	167.96 a ± 0.67	167.48 ± 0.65
4th M of LP	166.88 a ± 0.59	166.57 a ± 0.66	167.17 a ± 0.69	166.87 ± 0.65
5th M of LP	166.46 a ± 0.68	166.18 a ± 0.58	167.08 a ± 0.70	166.57 ± 0.65
Overall LP	167.48 a ± 0.63	167.32 a ± 0.66	168.18 a ± 0.66	167.66 ± 0.65

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

Abdominal girth (cm)

Table (4) represents the mean abdominal girth of animals of all three groups during dry period and after calving period of 5 months of lactation. There was significant difference ($p<0.05$) amongst overall means of all three groups before and after 5 months of calving. This may be due to more subcutaneous fat deposition which shows lesser negative energy balance for cows. It is evident higher BCS animals during lactation period had more AG. Present findings are in corroboration with Prasad (1994) [11] and Bhakat (2004), who found that there was correlation between AG and BCS.

Table 4: LSQ mean ± S.E of abdominal girth (cm) in Jersey crossbred cows

Months (M)	C	T1	T2	Overall
1st M of DP	206.92 a ± 1.47	207.50 a ± 1.49	210.75 b ± 1.53	208.39 ± 1.50
2nd M of DP	219.67 a ± 1.72	222.79 a ± 1.59	227.08 b ± 1.72	223.18 ± 1.68
Overall DP	213.29 a ± 1.60	215.14 a ± 1.54	218.92 b ± 1.63	215.78 ± 1.59
1st M of LP	211.67 a ± 1.69	214.00 a ± 1.62	219.08 b ± 1.53	214.92 ± 1.57
2nd M of LP	192.33 a ± 1.77	193.50 a ± 1.56	196.67 b ± 1.47	194.17 ± 1.6
3rd M of LP	192.00 a ± 1.48	193.29 a ± 1.72	196.17 b ± 1.71	193.82 ± 1.64
4th M of LP	191.50 a ± 1.81	192.89 a ± 1.57	196.08 b ± 1.63	193.49 ± 1.67
5th M of LP	191.46 a ± 1.46	192.86 a ± 1.59	195.83 b ± 1.49	193.38 ± 1.51
Overall LP	195.79 a ± 1.64	197.31 a ± 1.61	200.77 b ± 1.57	197.96 ± 1.61

Means with different superscripts differ significantly ($P<0.05$) from each other row wise

Conclusion

Correlation coefficients suggested that THT may be one of the very helpful tools to monitor BCS, milk yield and udder health of dairy cows. It can be concluded that Supplementation of pre and post-partum Alphatocopherol affects tail head thickness, body length, and abdominal girth of Jersey crossbred cows at tropical lower Gangetic region. Body measurements may be done to monitor cows' health and production. Supplementation of Alphatocopherol may help in improving THT and other body measurements for better milk performance and udder health.

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Conflict of interest: The authors declare that they have no conflict of interest.

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