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# Effect of dietary micronutrients on growth performance in growing crossbred calves

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**Abstract**
Twenty four female KF calves were selected and distributed randomly into 4 groups of 6 animals each based on their body weight and age in a randomised block design (RBD). In group $T_1$, the concentrate mixture consisted of mineral mixture without iodine. The animals in group $T_2$ and $T_3$ were supplemented with iodine at 0.25 and 0.5 ppm of dietary DM while in group $T_4$, 4 micronutrients i.e. chromium, naicin, vitamin E and Zn were supplemented @ 1.5, 600 40 and 40 ppm, respectively for 150 days. The initial DMI was 3.38kg, 3.65kg, 3.37kg and 3.46 kg and final 5.66kg, 5.67kg, 5.91kg and 5.69kg of $T_1$, $T_2$, $T_3$ and $T_4$ respectively; it is similar in all the groups. The initial mean body weight was 116.68 kg, 117.65 kg, 115.16 kg and 116.62 kg in $T_1$, $T_2$, $T_3$ and $T_4$ respectively and final mean body weight was 198.42, 201.15, 204.28 and 201.21 kg of $T_1$, $T_2$, $T_3$ and $T_4$. The mean values for ADG values were similar in all the groups, but significant ($P$<0.05) difference among season, higher in summer (544.36g) than winter (564.12g).

**Keywords:** Calves, body weight, heat stress, niacin, zinc, vitamin e, iodine

## Introduction
India cattle population 199.1 million in which crossbred contribute 39.73 millions [3]. Climate change is perceived as a major threat to the survival of many species and ecosystems as well as to the financial sustainability of pastoral systems in various parts of the world, especially in developing countries. Heat stress is the major problem due to vigourous changing of climaticstress resulting into reduced gut motility, ruminal contractions and depresses appetite, by having a negative effect on appetite center of the hypothalamus also affects performance parameters but various physiological and immunological parameters. If the heat load is above the animal's heat dissipation capability, the animal will respond to it through behavioral and physiological changes [8]. Heat stress can occur in dairy cattle when temperatures are above 25 ºC when combined with high humidity, low air flow and direct sun light [9]. Mild to severe heat stress in dairy cattle has been estimated to cause an increase in maintenance requirements by 7 to 25% [16]. "Animals maintain core body temperature by increasing their metabolism resulting in greater heat production, as well as other heat conservation strategies such as reducing blood flow to the extremities, shivering, and increased intake." Cold stress results in approximately a 1 percent increase in the maintenance energy requirement for each Celsius degree or two degrees. To overcome these problem below micronutrients such iodine, zinc, niacin, iodine, chromium and vitamin E are to be supplemented in our study.

## Materials and Methods
### Ethical approval
**The experiment was carried out according to the National Regulations on Animal Welfare and the Institutional Animal Ethical Committee.**
### Study design
The study was carried out at Livestock Research Center, National Dairy Research Institute, Karnal for 150 days on 24 female KF calves distributed randomly into 4 groups of 6 animals each based on their body weight and age in a randomized block design (RBD). At the beginning of the experiment, the average age and body weight of the calf in control group $T_1$ were 11.75±1.31Month and 116.68±16.35 kg, in $T_2$11.53±0.96 Month and 117.65±12.83 kg, in $T_3$11.03±1.03 Month 115.16±14.32 kg, and $T_4$ 11.86±0.95 Month and 116.68±16.35 kg respectively. The animals were clinically healthy and kept under the same conditions, with

appropriate facilities for feeding and watering. Concentrate mixture, sorghum/maize green fodder and wheat straw were supplied in the ratio of 40: 40: 20 (on DM basis) in all four types rations to meet the requirements [5]. In group $T_1$, the concentrate mixture consisted of mineral mixture without iodine. The animals in group $T_2$ and $T_3$ were supplemented with iodine at 0.25 and 0.5 ppm of dietary DM while in group $T_4$, 4 micronutrients i.e. chromium, niacin, vitamin E and Zn were supplemented @ 1.5, 600 40 and 40 ppm, respectively. The Ingredient composition of concentrate mixture has been given in Table 1. The effect of weather parameters, such as temperature and humidity, on the KF calves was expressed in terms of temperature humidity index (THI). Observations for THI were recorded at 8:30 am and 4:22 pm daily. The average THI was fortnightly calculated for the experimental period using the following formula given by U.S. Weather BureauC - wet bulb temperature (°C).

THI=0.72 (db °C+wb °C)+40.6

Body weight of individual calf was recorded at the onset of experiment and subsequently at fortnightly intervals by using digital weighing balance in the morning before feeding and watering of the animals. The animals were weighed for two consecutive days and then the average of two days was considered as the body weight for that fortnight. The change in body weight in relation to initial weight was considered as body weight gain or growth. Average daily gain (ADG) was calculated by subtracting the final body weight from the initial body weight and dividing it by the number of days. Structural growth measurements, viz. body height, hip height and heart girth, were performed using "tape measures." The feed intake and orts of the individual calf were recorded daily. The calves were offered measured amount of diet twice a day. After determining the dry matter (DM) content of feed offered and residue left, the mean dry matter intake (DMI) of each calf was calculated. Blood samples were collected fortnightly, and plasma was separated and stored at −20 °C for estimation of β-HBA levels using commercially available kits.

**Statistical analysis**

Statistical analysis of data was carried out to find the mean±SE. one way analysis of variance (ANOVA) techniques (By using SPSS software package) [9] The effects were considered to be significant at $p$ <.05.

**Results and Discussion**

**Environmental conditions during the experiment**

The maximum and minimum THI during morning time ranged from 76.18±0.28 to 49.48±1.05 respectively throughout the experimental period. During afternoon, the corresponding THI ranged from 85.60±0.48 and 61.42±0.6 (Fig 1) which were higher than the morning THI. The lowest morning THI was observed in II fortnight whereas highest morning was observed in fortnight X. The THI throughout the experimental period varied from 49.48-76.18 and 61.42-85.60 during morning and afternoon, respectively. THI below 72 indicating cold stress on the animals [11]. The experimental animals were under more cold stress during I-V Fortnight as the lowest THI values were observed in these months. The effect on the animal performance was greatest when THI exceeded 76 [3, 12, 8], Pattanaik and Kamal stated that degree of heat stress on the cattle and buffalo can be estimated by the THI value and THI above 72 is used to indicate heat stress on animals. The experimental animals were under more heat stress on VI-X Fortnight as the highest THI values were observed in these months.

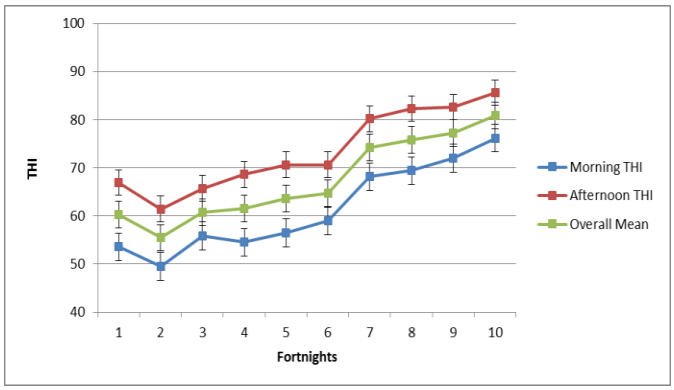


**Fig 1:** Effect of THI in different fortnights

**Dry matter intake**

Mean Dry matter Intake, body weight and DMI/100 kg BW of growing crossbred calves has been presented in the Table 2. There is no significant effect observe in mean DMI and body weight at the end of the 150 days experiment period. Result of present study are in agreement with those of research of Dutt [8] no significant effect on DMI treatment group then control group in dairy cows. Contrary to our study Pattanaik [15] reported Iodine supplementation @ 0.05 and 0.075 mg/animal/d improved live weight gain of goats Mean body measurement (body length, hip height, wither height, heart girth of growing crossbred calves has been presented in the Table 2. There is no significant differences observed in the body measurement but they are showing increasing trend with each succeeding fortnights which was expected as these were in active growing phase. Gill and Hafs. [3] Fuquay reported highly significant correlation between body weight and linear measurements of calves.

The mean β-HBA (mmol/ml) has been presented in the table 2 Overall β-HBA (mmol/ml)in groups $T_1$, $T_2$, $T_3$ and $T_4$ was 0.31±0.02, 0.28±0.01, 0.28±0.02and 0.26±0.01respectively. There were no significant differences observed among the treatment.

Similar to our findings Small (2010) found that supplementation of niacin had no significant effects on plasma BHBA in cow, additionally. Contrary to our finding Al-Abbasy [13] conducted a study in HF cows during summer and reported that supplementation of niacin resulted in significant ($P$<0.01) reduction ofβ-HBA, and Karkoodi and Tamizrad [4] also observed the same effect

**Table 1:** Proximate composition of diet (fed on % DM basis)

| Parameter | Concentrate Mixture | Sorghum | Maize fodder | Wheat straw |
|---|---|---|---|---|
| DM | 90.99 | 30.92 | 13.98 | 92.26 |
| OM | 92.73 | 88.81 | 89.38 | 88.44 |
| CP | 20.34 | 10.58 | 10.75 | 2.27 |
| Total ash | 08.26 | 11.19 | 10.62 | 11.56 |
| EE | 3.99 | 2.35 | 2.66 | 0.71 |
| NDF | 33.96 | 54.62 | 47.55 | 72.97 |
| ADF | 13.81 | 38.24 | 36.21 | 54.62 |
| TDN* | 68.38 | 60.42 | 62.66 | 45.34 |

**Table 2:** Effect of micronutrient on growth performancein growing crossbred calves supplemented with different micronutrients

| Fortnight | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
|---|---|---|---|---|
| DMI(fed on % DM basis) | 4.49±0.23 | 4.56±0.23 | 4.70±0.27 | 4.59±0.24 |
| DMI (kg/ 100 kg BW) | 2.79±0.05 | 2.79±0.06 | 2.82±0.89 | 2.82±0.82 |
| Body weight (Kg) | 198.42±18.96 | 201.15±13.75 | 204.28±14.34 | 201.21±12.75 |
| ADG (g) | 544.89±10.06 | 556.67±11.00 | 551.45±7.68 | 563.96±7.46 |
| Heart girth (cm) | 126.76±1.91 | 129.2±1.62 | 127.55±1.85 | 138±3.72 |
| Hip height (cm) | 108.82±1.30 | 109.83±1.37 | 108.55±1.24 | 111.09±1.32 |
| body length (cm) | 106.23±1.61 | 107.53±1.41 | 106.59±1.37 | 107.58±1.36 |
| wither height (cm) | 101.94±1.28 | 103.94±1.18 | 102.70±1.17 | 105.27±1.24 |
| β-HBA (mmol/ml) | 0.31±0.02 | 0.28±0.01 | 0.28±0.02 | 0.26±0.01 |

## Conclusions

There was no added benefit is found in growth parameter (body weight, body measurement and DMI) further more detail study needed to see the effect. Plasma β-HBA concentration was also similar in all groups with regard to treatments and seasons. The study concludes that micronutrients are did not effects significantly on growth parameter.

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