Research Article

Postpartum plasma profile of certain trace elements in Holstein Friesian cows with and without hormone therapy under tropical climate*

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ABSTRACT

A total of 131 parous lactating cows were observed for postpartum ovarian activity and other estrual events from day 15 post-partum freshly calved HF cows (24) of University farm were monitored for weekly plasma profile and certain trace elements from the day of calving till 21st week postpartum with and without GnRH (Receptal) and $PGF_2\alpha$ (Lutalyse) treatment at 7th week postpartum in anoestrus and suboestrus groups (6 each), respectively. The plasma zinc level of anoestrus cows was significantly higher at calving (1.23 ± 0.06 vs 1.06 ± 0.05 ppm) and lower at 3rd week postpartum (1.03 ± 0.07 vs 1.31 ± 0.08 ppm) than the suboestrus group. The weekly mean levels of zinc in GnRH and $PGF_2\alpha$ treatment and pooled groups fluctuated significantly, whereas in their control groups it varied non-significantly between different weeks postpartum. The values were relatively high at calving till 1 week postpartum compared to other intervals with identical profile at most intervals in all the groups. The plasma iron levels in anoestrus and suboestrus groups varied insignificantly at all intervals postpartum, except at 12th, 17th and 18th week, and the overall means (2.06 ± 0.05 vs 1.78 ± 0.05 ppm). The values were relatively low during early postpartum phase compared to 6 weeks later in all the groups, and did not differ significantly at any of the intervals postpartum, between treatment and control groups. The plasma copper concentration did not differ significantly at any of the intervals postpartum in GnRH and $PGF_2\alpha$ groups, and even between their treatment and control groups, including the overall pooled means (0.81± 0.01 vs 0.76± 0.02 ppm). The levels in all groups, except GnRH control and $PGF_2\alpha$ treatment groups, varied significantly ($P < 0.05$) between different weeks postpartum in the range of 0.61 ± 0.04 to 1.03 ± 0.04 ppm. The plasma cobalt and manganese concentration of GnRH and $PGF_2\alpha$ treatment, control and their pooled groups varied insignificantly between different weeks postpartum (0.31 ± 0.04 to 0.59 ± 0.04 and 0.05 ± 0.01 to 0.13 ± 0.03 ppm), and it did not differ significantly between groups at any of the intervals postpartum, except that copper was significantly higher at 20th week both in GnRH and $PGF_2\alpha$ treatments than their control groups.

Key words: Holstein Friesian cows, hormone therapy, postpartum period, trace elements

Trace minerals (Cu, Co, Se, Mn, Zn and iodine) play an important regulatory role in reproductive performance of ruminants (Hidiroglou, 1979). Dairy animals have been frequently affected with varying degree of Cu, Co, Mn and Zn deficiency in various regions of the world (Rogers, 1992). The imbalance leads to inactive ovaries and/or repeat breeding. Moreover, early postpartum period exerts physiological stress on the dam resulting into altered blood metabolic profile (Setia *et al.*, 1994). Evaluation of plasma profile of certain biochemical and mineral constituents has been made during peripartum period and under various reproductive physio-pathological conditions of zebu cows and buffaloes (Setia *et al.*, 1994; Khasatiya *et al.*, 2006) and even in exotic cattle from abroad (Sato, 1978; Kappel *et al.*, 1984). However, no literature was available on monitoring the postpartum plasma profile of trace elements in exotic cattle born and brought up under tropical climate. Hence, the present study was aimed to monitor the trace elements profile during early

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postpartum period and to see the effect of GnRH and $PGF_2\alpha$ treatment on this in HF cows under tropical farm management.

MATERIALS AND METHODS

This study was conducted over first 150 days postpartum on 24 healthy normally calved HF cows managed under routine feeding and housing protocol of University farm at Anand, during November 2002 to June 2003. The objective was to monitor postpartum period through clinical diagnosis and weekly plasma profile of certain trace minerals with and without GnRH and $PGF_2\alpha$ treatment at day 48 (7th week) postpartum. A group of 6 animals having small inactive ovaries till day 48-49 postpartum were treated on that day with the single i/m injection of 0.02 mg (5 ml) Buserelin acetate (GnRH analogue, Receptal®, Intervet India Pvt. Ltd.) keeping 6 animals of similar nature as control. Another group of 6 suboestrus animals were treated with single i/m injection of 25 mg (5 ml) Dinoprost tromethamin, THAM salt (Lutalyse®, Pharmacia & Upjohn), a naturally occurring $PGF_2\alpha$, between day 48 and 55 postpartum after confirming the presence of mature corpus luteum on either of the ovaries keeping 6 animals of similar nature as untreated control.

All the animals of above two treatment groups and their controls were followed and compared for their clinical response. Cows exhibiting signs of oestrus were bred only after 50 days of calving by AI using frozen-thawed semen and were palpated per rectum for pregnancy 45 days later. Heparinized venous blood samples were collected from all 24 cows at regular weekly interval from the day of calving till 150 days (21 weeks) postpartum. The plasma samples were stored frozen at –20°C till analysed. The levels of trace elements, viz. zinc, iron, copper, cobalt and manganese were determined in wet oxidized plasma samples on an atomic absorption spectrophotometer (Oser, 1979). The data were analyzed statistically using CRD, Duncan's NMRT and Student's 't' test to know the weekly/ group variation, if any (Steel and Torrie, 1981).

RESULTS AND DISCUSSION

The weekly mean plasma profiles of trace elements studied in GnRH and $PGF_2\alpha$ treatment and their control groups of HF cows during first 21 weeks postpartum is presented in fig 1.

The zinc level of cows in anoestrus (GnRH) and suboestrus ($PGF_2\alpha$) groups did not differ significantly at any of the intervals postpartum, including the overall means (1.09 ± 0.02 vs 1.04 ± 0.01 ppm), except at calving (1.23 ± 0.06 vs 1.06 ± 0.05 ppm) where it was significantly higher in anoestrus group. Moreover, the weekly mean plasma zinc levels of GnRH treatment, control and their pooled groups fluctuated significantly ($P < 0.05$) between different weeks postpartum in the range of 0.87 ± 0.09 to 1.56 ± 0.19 ppm. The values were relatively high at calving till 1 week postpartum and again from 4th to 7th week postpartum compared to other intervals with identical profile in all the groups. Like GnRH groups, the plasma zinc level in $PGF_2\alpha$ treatment, control and pooled groups was also relatively higher during first few weeks postpartum and it fluctuated significantly between different weeks postpartum in the range of 0.68 ± 0.12 to 1.32 ± 0.06 ppm. Further, the zinc level was significantly lower in $PGF_2\alpha$ treatment than the control group at calving and at 7th and 16th week postpartum including the overall means (0.97 ± 0.02 vs 1.12 ± 0.02 ppm; fig 1). These findings corroborated with the report of Rupde *et al.* (1993), who stated that zinc level was not related to postpartum anoestrus period or fertility in cows. Further, the decreasing trend of zinc levels observed in early postpartum period also supported the findings of Mehere *et al.* (2002) in cattle and Khasatiya *et al.* (2006) in buffaloes. This may be due to its requirement for transport of $PGF_2\alpha$ to the ovary for rapid luteolysis postpartum as a micronutrient component of many enzyme systems including carbonic anhydrase. Jacob *et al.* (2003) reported significant rise in zinc level at one month postpartum compared to level at calving. Setia *et al.* (1994) also noted high levels during early to mid lactation as compared to values at calving. The present values of zinc were above the critical limit of 0.6 to 0.8 µg/ml suggested by Mc Dowell (1992). Kalita *et al.* (1999) found significantly low level of zinc in repeat breeder and anoestrus cows as compared to normal cyclic cows.

The iron levels of cows in anestrus (GnRH) and suboestrus ($PGF_2\alpha$) groups did not differ significantly at any of the intervals postpartum, except at 12th and 18th week postpartum, and in the overall means (2.06 ± 0.05 vs 1.78 ± 0.05 ppm). Moreover, the weekly mean plasma iron concentration of GnRH treatment, control and their pooled groups fluctuated non-significantly between 1.37 ± 0.33 and 2.98 ± 0.08 ppm among different weeks postpartum. The values were relatively low during early postpartum phase compared to 6 weeks later in all the groups. The weekly mean plasma iron levels of $PGF_2\alpha$ treatment, control and pooled groups were more or less identical throughout the postpartum period and fluctuated between different intervals postpartum in the narrow range of 1.26 ± 0.15 to 2.55 ± 0.22 ppm (Fig. 1). The present postpartum trend and levels of iron coincided well with the reports of Bostedt *et al.* (1974) and Rupde *et al.* (1993). Khasatiya *et al.* (2006) also found similar trend with little higher values in Surti buffaloes from calving till 15th week postpartum with or without GnRH and $PGF_2\alpha$ therapy. Setia *et al.* (1994) reported identical levels of iron throughout the postpartum period from calving till mid lactation in cows. Ramakrishna (1997) reported significantly higher serum iron concentration in repeat breeding and anoestrus cows than cyclic cows, while Kalita *et al.* (1999) observed significantly lower iron level in repeat breeders as compared to cyclic cows. Similarly, Mehere *et al.* (2002) and Jacob *et al.* (2003) found almost same values of serum iron level from day of calving till 4 weeks postpartum.

The plasma copper concentrations of anoestrus (GnRH) and suboestrus ($PGF_2\alpha$) groups did not differ significantly at any of the intervals postpartum, including the overall pooled means (0.81± 0.01 vs 0.76 ± 0.02 ppm), though the values were little higher in GnRH group at all stages postpartum. Further, the weekly mean plasma copper levels in GnRH treatment and $PGF_2\alpha$ control groups varied significantly ($P < 0.05$) between different weeks postpartum in the range of 0.61 ± 0.04 to 1.03 ± 0.04 ppm. The values were lower during first 10 weeks postpartum compared to later intervals in all the groups. The weekly mean values of copper were significantly higher in GnRH treatment than the control group at 15th and 16th week postpartum, but were significantly lower ($P < 0.01$) in $PGF_2\alpha$ treatment than the control group at 20th and 21st week postpartum (Fig. 1). These findings closely corroborated with the reports of Bostedt *et al.* (1974) in cattle and Khasatiya *et al.* (2006) in buffaloes. They found almost uniform levels of serum copper during parturition and puerperal period. The effect of GnRH and $PGF_2\alpha$ treatment on day 42 postpartum in the later study was similar to our findings. However, Mehere *et al.* (2002) observed significantly lower serum copper levels at parturition as compared to rising trend for first 4-6 weeks postpartum in crossbred cows. Setia *et al.* (1994) recorded little lower serum copper during early lactation than at calving or late lactation. Rupde *et al.* (1993) found significantly low level of serum copper in repeat breeder cows than the normal cyclic ones. Like iron, the lower concentration of copper recorded at parturition followed by increasing trend after 4-5 weeks postpartum could be due to increased transfer of these nutrients across the placenta and haemodilution during late pregnancy and at calving, together with initiation of ovarian follicular activity postpartum, leading to high circulatory oestrogens which stimulate binding of iron and copper with the proteins in liver and thereby increased concentration in plasma (Mehere *et al.*, 2002).

There was no significant difference in the cobalt concentration between cows of anoestrus (GnRH) and suboestrus ($PGF_2\alpha$) groups at any of the intervals postpartum, including the overall means (0.42 ± 0.01 vs 0.43 ± 0.01 ppm). Moreover, the weekly mean plasma cobalt concentration of both GnRH and $PGF_2\alpha$ treatment and their control groups fluctuated non-significantly between different weeks postpartum in the narrow range of 0.31 ± 0.04 to 0.59 ± 0.04 ppm. The overall mean cobalt content was significantly higher in GnRH treatment than the control group (0.46 ± 0.02 vs 0.39 ± 0.01 ppm), though it did not vary significantly at any of the weekly interval. Similarly, the levels in $PGF_2\alpha$ treatment and control groups were almost identical through out the postpartum period, including the overall means (0.42 ± 0.02 vs 0.45 ± 0.01 ppm), except at 12th week where it was significantly lower and at 20th week postpartum it was significantly higher in $PGF_2\alpha$ treatment than the control group (Fig. 1). The present findings were

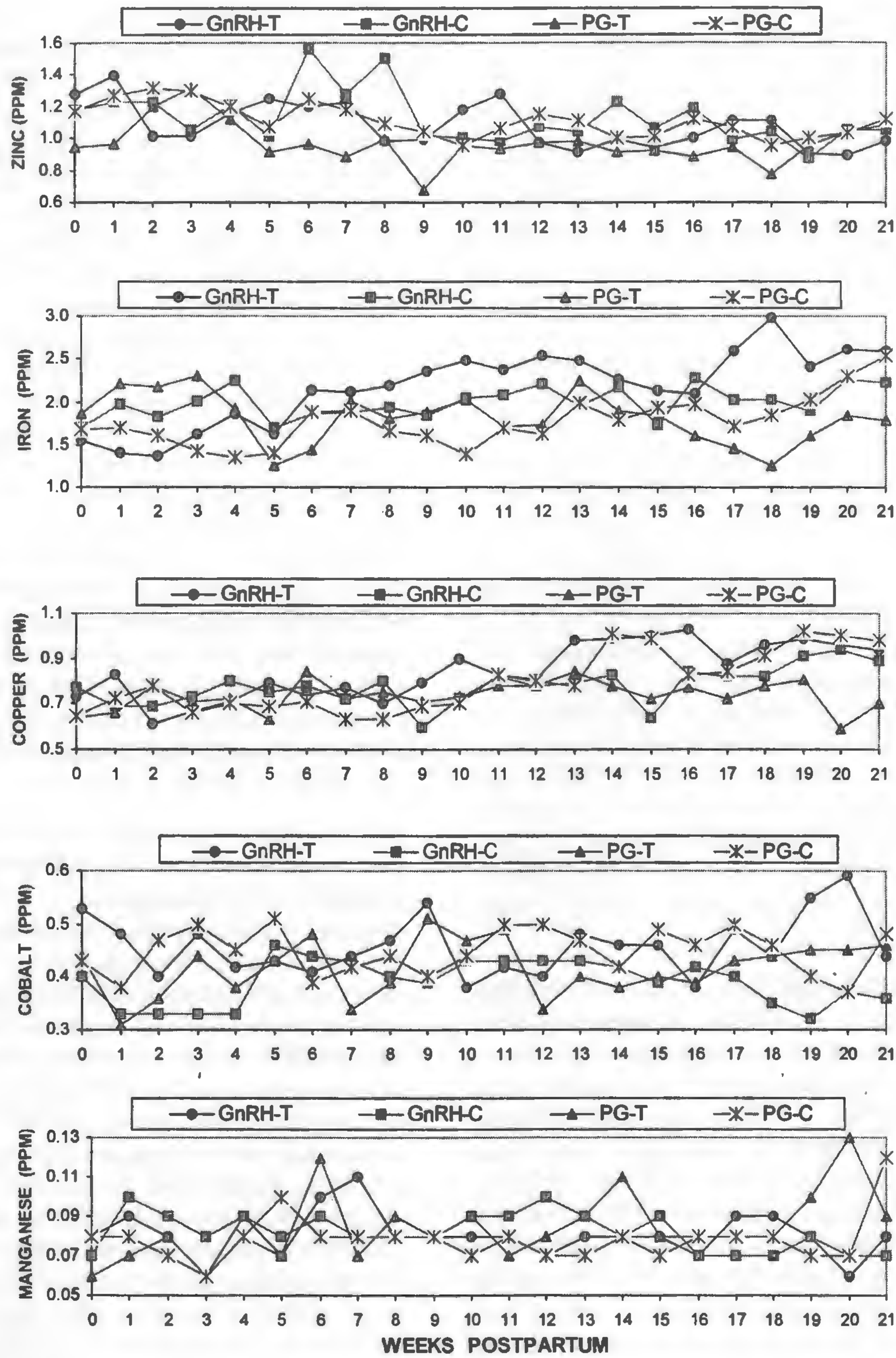

Fig 1: Postpartum weekly plasma profile of trace elements in anoestrus and suboestrus HF cows under GnRH and PGF2 α treatment and control regimes

in agreement with the observations of Khasatiya *et al.* (2006), who reported non-significant variation in plasma cobalt concentration from calving till 15th week postpartum in Surti buffaloes using same GnRH and $PGF_2\alpha$ treatment protocol. Setia *et al.* (1994) found identical plasma cobalt levels at calving and early to mid lactation. Mehere *et al.* (2002) found the value at 4 weeks prepartum to be significantly higher than on the day of calving and at 1st and 4th week postpartum (0.62 vs 0.22 to 0.27 ppm) in cows.

The weekly plasma manganese concentration in both GnRH and $PGF_2\alpha$ treatment, control and their pooled groups fluctuated non-significantly between different weeks postpartum in the narrow range of 0.06 ± 0.01 to 0.13 ± 0.03 ppm, with the identical overall mean of 0.08 ± 0.01 ppm in all the groups. Moreover, there was no significant difference between treatment and control groups in either GnRH or $PGF_2\alpha$ treatment and control groups at any of the intervals postpartum, or even between anoestrus and suboestrus groups, except at 1st week postpartum (0.10 ± 0.01 vs 0.07 ± 0.01 ppm) where it was significantly higher in anoestrus than the suboestrus group. These findings on manganese levels and trend closely coincided with the report of Khasatiya *et al.* (2006) in Surti buffaloes. Kalita *et al.* (1999) reported that the manganese concentration in normal cyclic and repeat breeder cows did not differ significantly. However, Rupde *et al.* (1993) observed significantly lower serum manganese level in repeat breeder and anoestrus cows than the normal cyclic cows. Further, almost uniform levels of plasma/serum manganese concentration have been documented earlier by some workers from calving till mid lactation (Setia *et al.*, 1994). Mehere *et al.* (2002), however, observed 2 to 2.5 folds high value of serum manganese at 4 weeks postpartum than that at calving or 4 weeks prepartum in crossbred cows. Manganese is one of the important micronutrients essential for reproductive rhythm and is an integral component of several enzymes involved in reproduction. However, we could not see such role in this study of any micro-mineral evaluated and their blood levels were also high, probably due to their regular supplementation in the ration of experimental animals, thus raising the level much above the critical limits required/suggested for sound health and reproduction by Mc Dowell (1992).

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