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Study on metabolic profile of Deoni cows in transition period

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Abstract

The present study was undertaken to evaluate the metabolic shifts during the transition period in Deoni cows. Thirty Deoni cows were selected for the study maintained at Livestock Research and Information Centre (Deoni) with similar feeding habits and management which were equally divided in to group I (pre-partum), group II (at the time of parturition) and group III (post-partum 3-4 weeks). Haematological parameters such as haemogram, leucogram and erythrocyte indices and biochemical parameters such as calcium, phosphorus, magnesium, SGOT, triglycerides, total proteins, albumin, blood urea nitrogen and glucose were estimated and compared with healthy control. Haemogram reduced significantly in pre-partum period and at the time of parturition compared to healthy control group with corresponding decrease in MCH and MCHC suggestive of marginal anaemia. The TLC values were significantly lower at the time of parturition when compared to healthy control group. There was marginal hypocalcaemia, hypophosphataemia and hypoglycaemia observed at the time of parturition and in post-partum period when compared with healthy control group. Marginal decrease in total protein and albumin at the time of calving and post-partum period was indicative of requirement of necessary incorporation of protein in diet. SGOT, BUN and Mg values were within normal physiological limits. The results indicated that there was metabolic shift in haemato-biochemical parameters in the transient period of Deoni cows and hence incorporation of quality mineral mixture in the diet of cows at the time of parturition till 3-4 weeks post-partum is recommended.

Keywords: Metabolic profile, Transition Period, Deoni cows, and Hypocalcaemia

Introduction

Metabolic profile testing is widely used to identify subclinical metabolic changes during the transition period in herd. The transition period, the period from 3 weeks prior to calving to 3 weeks after calving, is the most stressful period experienced during the cow's lactation. According to LeBlanc *et al.* (2006) ^[10] estimates that 75 per cent of all disease occurs during transition period. So, it is necessary to carry out the metabolic profile testing in transition period. In India, the highest milk yield is being produced by indigenous cows to the tune of 18.66 million tons per year about 12 per cent of the total milk production. There are thirty seven recognized breeds of cattle in India, in addition to large number of non-descript cattle. The exotic and crossbred cows are not only vulnerable to exotic diseases however other challenges like shortage of feed and fodder, sustainability to the drought condition. The Government of India took the initiative to conserve and maintain the indigenous breeds which have merits over the exotic breeds (National Livestock policy, 2013). The indigenous cows which are moderate milk yielders too experience the metabolic shifts during the transition period. Thus, the present study aims at identifying the metabolic shifts in Deoni cows during the transition period.

Materials and Methods

Thirty Deoni cows were selected for the study maintained at Livestock Research and Information Centre (Deoni) with similar feeding habits and management, which were equally divided in to group I (3 weeks pre-partum), group II (at the time of parturition) and group III (post-partum 3-4 weeks). The selected animals for the study aged between 8 to 12 years old and average milk production of the cows was 3 to 4 litres per day. Blood samples (2 ml) were collected by jugular venipuncture of the selected animals in to the sterile vials containing disodium salts of EDTA as anticoagulant under aseptic conditions and were labelled properly according to groups.

Samples bought to laboratory for haematological investigation such as haemogram, leucogram and erythrocyte indices were carried out on fully automated haematology cell counter-Automatic Blood cell Counter.

For biochemical estimations 10 ml blood was collected in vials coated with clot activators and blood was allowed to coagulate. Serum was separated by centrifugation at 2500 rpm for 10 minutes and serum was collected in eppendorf tubes, labelled accordingly and maintained at -20°C until analysis. The biochemical parameters such as calcium, phosphorus, magnesium, SGOT, triglycerides, total proteins, albumin, blood urea nitrogen and glucose were estimated by ARTOS® semi automatic biochemical analyser and compared with healthy control group consisting of 10 animals which were devoid of pregnancy and lactation stress.

The haematological and biochemical values obtained on three weeks prepartum, on the day of parturition and three weeks post partum samples were subjected to statistical analysis by one way ANOVA using Statistical Package for Social Sciences (SPSS) version 20. Differences between means were tested using Duncan's multiple comparison test and significance was set at 5 per cent (p<0.05) and also at 1 per cent (p<0.01).

Results and Discussion

The haemato- biochemical parameters were evaluated in transition Doeni cows. Various haematological and biochemical changes were observed in Doeni cows due their adaptation in the transition period. The haematological parameters are tabulated in table (1) and biochemical parameters are tabulated in Table (2).

Haemogram

The Mean TEC values were significantly (P<0.05) lower in the groups of the transition period when compared to mean values in healthy control group (Table 1). Reduced values of

TEC prior to parturition and at the time of parturition in the transition period were in accordance with Ambica and Rao (2012) [1] observed in crossbred cows. Similarly, Mean values of haemoglobin in pre-partum period and at the time of parturition were significantly (P<0.05) lower when compared to healthy control group (Table 1). The present observations of the study were in accordance with Sawalkar *et al.* (2011) [20] in crossbred cows. The haematocrit values in pre-partum period were significantly (P<0.05) lower when compared to healthy control group and post-partum period (Table 1). Similar results were found by Seifi *et al.* (2003) [22] in HF cows and Mir *et al.* (2008) [13] in crossbred cows. Low haematocrit values in the transition period had been attributed to diminished immunological status there by suppression of erythropoiesis from bone marrow (Detilleux *et al.*, 2004) [6] in HF cows. Hypoproteinaemia and protein deficiency has also been linked with low haemoglobin production (Coles, 1986) [5] which was also observed in the present investigation.

Leucogram

In the present study, Mean values of TLC in pre-partum period and at the time of parturition were significantly (P<0.01) lower when compared to control group. The reduction in TLC was more prominent in pre-partum and at the time of parturition when compared to post partum group. The results of the present study were in accordance with Mallard *et al.* (1998) [11] in dairy cows and Ambica and Rao (2012) [1] in crossbred cows. Low leucogram at the time of parturition is possibly attributed to increased glucocorticoids, known immunosuppressants (Roth and Kaerberle, 1982) [18], were elevated at parturition, and have therefore been postulated to play a role in periparturient immunosuppression. More over cows during transition period undergo a period of reduced immunological capacity which is multifactorial (Mallard *et al.*1998) [11] and could substantiate the low TLC values observed in pre-partum cows in present investigation.

Table 1: Comparison of Mean ± SE values of haematological parameters in transition period in comparison with healthy control group

Parameter	Control Group	Group I (pre-partum)	Group II (at parturition)	Group III (post-partum)
TEC	7.25±0.32 ^a	6.13±0.39 ^b	6.62±0.39 ^{ab}	6.99±0.21 ^{ab}
Hb	11.27±0.25 ^a	8.79±0.19 ^b	8.11±0.29 ^b	11.06±0.43 ^a
TLC	11.02±0.58 ^c	8.34±0.18 ^b	7.01±0.22 ^a	10.58±0.43 ^c
PCV	34.17±0.68 ^a	30.30±1.24 ^b	31.98±1.77 ^{ab}	34.53±0.92 ^a
MCV	47.93±2.27	48.37±1.45	48.58±1.48	49.56±1.29
MCH	15.69±0.41 ^a	13.71±0.48 ^b	12.6±0.81 ^b	15.91±0.70 ^a
MCHC	33.09±1.06 ^a	28.51±1.12 ^{bc}	26.05±1.70 ^c	32.13±1.23 ^{ab}
PLT	129.20±5.17	146.20±9.81	152.00±8.27	146.70±9.86

Means with dissimilar superscripts differ significantly

Table 2: Comparison of Mean ± SE values of biochemical parameters in transition period in comparison with healthy control group

Parameter	Control Group	Group I (pre-partum)	Group II (at parturition)	Group III (post-partum)
Ca	9.98±0.33 ^a	8.92±0.24 ^b	7.51±0.28 ^c	7.63±0.42 ^c
Mg	3.31±0.14 ^a	3.13±0.08 ^a	1.99±0.06 ^c	2.56±0.04 ^b
P	5.12±0.22 ^a	3.80±0.29 ^b	3.10±0.22 ^b	3.37±0.35 ^b
Total Protein	7.01±0.14 ^{ab}	6.58±0.22 ^a	6.75±0.29 ^{ab}	7.35±0.29 ^a
Albumin	3.81±0.12 ^a	3.14±0.15 ^b	3.27±0.19 ^b	3.36±0.10 ^b
SGOT	58.88±2.29 ^{ab}	50.61±3.41 ^b	55.37±2.54 ^{ab}	64.49±3.68 ^c
Glucose	53.84±1.6 ^a	36.67±2.47 ^b	30.41±2.06 ^c	30.30±1.61 ^c
Triglycerides	47.80±2.24 ^a	32.79±2.28 ^b	41.96±6.09 ^{ab}	50.23±3.63 ^a
BUN	19.81±.43 ^a	16.84±0.81 ^c	19.29±0.63 ^{ab}	17.13±1.15 ^{bc}

Means with dissimilar superscripts differ significantly

Erythrocytic Indices

As the erythrocytic indices are arithmetic representatives of haemogram, corresponding decrease has been observed in MCH and MCHC. Mean MCH and MCHC values in pre-partum period and at the time of parturition were significantly lower when compared to healthy control group (Table 1). Similar results were found by Mir *et al.* (2008) [13] in crossbred cows and could be attributed to diminished immunogenic status (Dettleux *et al.*, 2004) [6] in periparturient animals.

Biochemical Observations

The serum calcium values at the time of parturition and in post-partum period were significantly ($P < 0.01$) lower compared to healthy control group and was suggestive of hypocalcaemia (Table 2). This decline was more pronounced at the time of parturition (Group II) and post partum period (Group III). The decrease in the level of calcium might be due the drain of calcium in the colostrum and milk after parturition in post-partum period (Gupta *et al.*, 1995) [7]. Transient hypocalcaemia in the pre-partum cows (group I) could be attributed to impaired absorption of calcium and overload through the supplement for foetus in pre partum period (Pal and Acharya., 2013) [14].

The mean values of phosphorus in all the groups of present study were significantly ($P < 0.01$) lower when compared to control group (Table 2). Similar decrease in the level of phosphorus in transition period has been quoted in earlier reports by Pal and Bhatta. (2013) [15] in HF cows and Van saun (2016) in transition cows. The reduced values of phosphorus at the time of parturition might be due to utilization of phosphorus at this stage with enhanced carbohydrate metabolism (Sahukar *et al.*, 1984) [19] and also required for the foetal growth (Jacob *et al.*, 2002) [9] as observed in pre-partum cows (group I) in present investigation. In post-partum period, decrease in the level of phosphorus might be attributed to increased excretion of phosphorus in colostrum and milk (Rook and Thomus, 1983) [17] and increased activity of parathyroid hormone (PTH) (Ambica and Rao 2012) [1] to compensate hypocalcaemia. The Mean values of serum magnesium were within the normal physiological limits though serum magnesium showed significant difference in transition period when compared to healthy control group. However, contrary to the present investigation there was significant decrease in the level of magnesium on 7th day post-partum as reported by Yousuf *et al.* (2016) [23] in crossbred cows which could be due to more production stress of high milk yield.

The Mean values of total protein in pre-partum period (group I) and at the time of parturition (group II) were significantly ($P < 0.05$) lower when compared to healthy control group (Table 2). The sharp drop in total protein level on the day or two day before and after parturition has been attributed to drain of immune fraction (globulins) in the formation of colostrum (Mehta *et al.*, 1989) [12] in crossbred dairy cows. Similarly transient hypoproteinemia observed in the pre-partum group (group-I) could be attributed to requirement protein for foetal growth (Jacob *et al.*, 2002) [9]. In the present investigation, there were significant ($P < 0.05$) decrease in the level of albumin in pre-partum period and at the time of parturition when compared to control group (Table 2) and similar results were drawn by Burke *et al.* (2010) who stated that the albumin concentrations were reduced at calving in dairy cows. Decreased albumin level has been attributed to

lactation stress at the time of parturition (Ambica and Rao 2012) [1] in crossbred cows. Compromised liver function observed in cows immediately after parturition due to hepatic lipidosis (Radostits *et al.*, 2008) has been documented and could justify the low levels observed in Deoni cows at the time of parturition in present investigation.

In the present study, the values of glucose were significantly lower in all the groups of present study when compared to control group (Table 2). Hypoglycaemia was more prominent at the time of parturition and during post-partum when compared to pre-partum period. These findings were concurred with the Blum *et al.* (1983), Seifi *et al.* (2007) [21] and Yousuf *et al.* (2016) [23] in crossbred cows. Hypoglycaemia in transition period might be attributed to several hormonal changes, primarily to regulate parturition and initiate lactation, and secondly to adapt metabolism to those events (Ingvarsen 2006) [8]. These mechanisms produce a hypoglycaemic state after parturition (Butler 2005) [4] in dairy cows. Glucose is also the primary metabolic fuel and required for the vital organs functions, foetal growth and milk production (LeBanc *et al.*, 2006).

As the triglycerides values remained within physiological limits though these values showed difference within the transition period. However, contradictory to the present study, Yousuf *et al.* (2016) [23] reported that increased triglycerides in stage II (7 days after parturition) and III (2 months after parturition) than in stage I (2 months before parturition) in crossbred cows. The marked increase in the values of triglycerides were reported in the high yielding crossbred cows whereas present study was conducted on Deoni cows which were low to moderate milking animals and therefore showed minor fluctuations in triglycerides values.

In the study conducted, the serum urea nitrogen levels were within normal physiological limits though there was significant difference between the study groups of the transition period. On the contrary, increased BUN at 21st day post-partum was reported by Seifi *et al.* (2007) [21] in dairy cows. As the SGOT values remained within physiological limits though these values showed difference within the transition period. However, contradictory to the present investigation, Seifi *et al.* (2007) [21] reported that elevated SGOT values in transition period of dairy HF cows.

Conclusion

Low haemogram with corresponding decrease in MCH, MCHC and low leucogram was more pronounced during pre-partum and at the time of parturition when compared to post-partum period. Marginal hypocalcaemia, hypophosphatemia and hypoglycaemia were observed at the time of parturition and post-partum period than pre-partum period suggestive of lactation stress. Though Deoni cows are low to medium milk yielders, the haemato-biochemical changes observed during transient period in the present investigation warranted necessary dietary incorporation of quality mineral mixture to avoid occurrence of metabolic disorder.

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