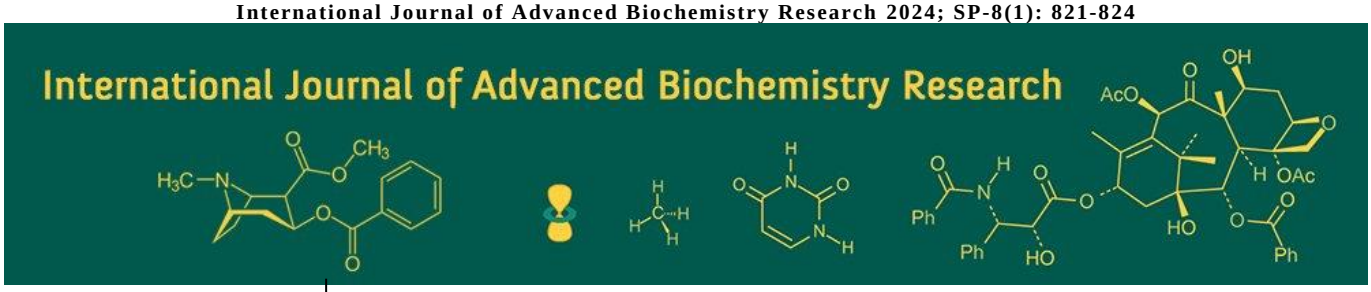

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(1): 821-824
www.biochemjournal.com
Received: 15-10-2023
Accepted: 30-11-2023

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Haemato-biochemical changes associated with peri-parturient period in dairy cows

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DOI: https://doi.org/10.33545/26174693.2024.v8.i1Sk.449

Abstract
Peri-parturient period in cows is often considered to be between 3 weeks pre-partum to 3 weeks post-partum. It is the most stressful phase of transition for dairy cows from pregnant non-lactating state to lactation. A total of 42 peri-parturient Gir cows were included in the present study to determine the haemato-biochemical alterations during peri-parturient period. Ten apparently healthy Gir cows were also selected (which were outside the peri-parturient period) to have base line data on haemato-biochemical parameters for the comparison and analysis. There was significant (p<0.05) decrease in haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC) and lymphocytes during peri-parturient period in dairy cows whereas, neutrophils were found significantly (p<0.05) increased. There was also significant (p<0.01) decrease in total leucocytes counts (TLC) during peri-parturient period Non-significant differences were observed in platelet count, monocytes count, eosinophils count and basophils count in dairy cows during peri-parturient period and control animals. The biochemical parameters revealed highly significant decrease (p<0.01) in serum glucose, calcium (Ca), phosphorus (P) and magnesium (Mg) during peri-parturient period as compared to control group. Total proteins (TP) and albumin were also found significantly (p<0.05) decreased. There was significant increase (p<0.05) in blood urea nitrogen (BUN) concentration during peri-parturient period as compared to control group.

Keywords: Dairy cow, haemato-biochemical, peri-parturient period

Introduction
Peri-parturient period generally refers to 21 days pre-partum to 21 days post-partum period, which is very exhausting stage. It is transition phase for dairy cows, from pregnant non-lactating state to lactation state. The cow's body goes through a number of physiological adjustments during this transitional phase, which causes noticeable alterations in its metabolic profile (Puppel and Kuczynska, 2016) [17]. Metabolic stress develops, when a dairy cow is unable to adjust to the growing demands of the transition phase, such as fetal growth and onset of lactation. The energy need of a peri-parturient cow increases from about 1 kg/day of glucose during late gestation to 2.5 kg/day during the first three weeks following calving (Reynolds *et al*., 2003) [20].

High producing dairy animals undergo negative energy balance, protein and mineral imbalances and oxidative stress resulting in immuno-suppression and decreased neutrophill and lymphocyte functions (Sundrum, 2015) [27], when nutrient requirements are not fullfilled. There is a substantial spike in the incidence of metabolic diseases such fatty liver, hypocalcaemia, mastitis, and ketosis. The metabolic profile test is an indicator of sub-clinical metabolic disturbance in dairy animals and assists for earlier detection of metabolic diseases.

Metabolic profile assessment is being proved to be the most effective method for evaluating the nutritional condition of dairy herds using just a simple blood test (Amle *et al*., 2014) [3]. Dairy cows' blood metabolic profiles can differ for a variety of genetic and non-genetic factors, including age, physiological states as pregnancy and lactation, diet and management practices like housing and microclimate (Jain *et al*., 2017) [16]. Therefore current study was conducted to evaluate the haemato-biochemical profile of peri-parturient Gir cows.

Materials and Methods

Total 42 peri-parturient Gir cows; raised on different organized and unorganized dairy farms of Udaipur district were covered under the present investigation. This study was conducted for period of 6 months under the Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Navania, Vallabhnagar, Udaipur (RAJUVAS, Bikaner).

Collection of blood samples

Blood samples were collected twice from each animal. First time samples were collected during 21 to 3 days prior to expected date of calving and second time, between 3 to 21 days post calving. Duration of three days before and after parturition was excluded, as these days are very crucial due to the occurrence of major endocrinological changes during this period. Blood samples were drawn from the jugular vein in sterilized tubes maintaining all aseptic precautions.

Laboratory Investigations

Haematological investigations were conducted to determine the values of Haemoglobin (Hb), Packed cell volume (PCV), Total erythrocyte count (TEC), Total leukocyte count (TLC) and Differential leukocytes count (DLC) as per the methods outlined by Feldman *et al*., (2000) [11].

All the biochemical parameters were determined by automated serum biochemistry analyzer (IDEXX Vet test chemistry analyzer). Estimated parameters were serum glucose, total protein, albumin, blood urea nitrogen (BUN), calcium (Ca), phosphorus (P) and magnesium (Mg).

Statistical analysis

The data obtained were statistically analyzed and compared as per standard protocol explained by Snedecor and Cochran (2004) [29].

Results and Discussion

Haematological parameters

There was significant reduction in haemoglobin concentration, packed cell volume and total erythrocyte count ($p<0.05$) during post-partum period in Gir cows in contrast with that of healthy control group animals (Table 1). Although, during pre-partum period also there was reduced Hb, PCV and TEC as compared to control animals, but variation was only significant for total erythrocyte count. Significant reduction in PCV value was also recorded between pre-partum and post-partum group.

The results of Sateesh *et al.* (2018) [22], Singh *et al*. (2020) [24] and Reddy and Sivajothi (2020) [19] were also in agreement with present study.

The lower erythropoiesis rate in the early postpartum period and the increased hemoglobin need of mammary cells for the production of milk and the corresponding increase in blood flow to the mammary glands may be the cause of the decreased haemoglobin concentration (Kumar and Pachauri, 2000) [12]. Poor immunological state and erythropoiesis suppression may contribute to lower hematocrit value during the peri-parturient phase (Detilleux *et al*., 1994) [4].

The platelet count was within normal physiological range in control group as well as throughout the peri-parturient period in Gir cows and the difference between groups was also non-significant. Similar observations were also made by Joshi *et al*. (2018) [10].

In peri-parturient period (pre-partum and post-partum period) there was significant leukopenia ($p<0.01$) in contrast with control animals. Similar results were also reported by Ambica and Rao (2012) [2] and Vasantha *et al*. (2020) [28]. Leukopenia during peri-parturient period is possibly attributed to increased level of glucocorticoids and reduced immunological capacity.

There was marked increase ($p<0.01$) in total leukocyte count in dairy cows throughout post-partum period than the pre-partum period. This increase might be due to physiological adrenaline secretion which results increased mobilization of neutrophils in the blood stream (Kramer, 2000 and Roy *et al*., 2010) [11, 21].

There was significant decrease in lymphocytes in Gir cows during peri-parturient period (pre-partum period and post-partum period both), while neutrophils were increased as compared to healthy cows. Non-significant variation was seen in monocytes, eosinophils and basophils. Patel *et al*. (2017) [16] and Abdelrazek *et al.* (2018) [1] also observed lymphocytopenia and neutrophilia. Increased cortisol levels during calving may be responsible for lymphocytopenia (Jacor *et al*., 2001) [9]. During transition period in dairy cows, the corticosteroids are released which induce neutophilia by increasing the synthesis of cells from the bone marrow or by an increased demargination of the cells from the endothelium.

Biochemical parameters

Serum glucose was significantly reduced ($p<0.01$) (Table 2) in peri-parturient cows as compared to healthy control. The difference between pre-partum and post-partum group was also significant. Results of current study are coinciding with Singh *et al*. (2017) [25]. Hypoglycaemia during peri-parturient period might be due to several hormonal fluctuations associated with parturition and onset of lactation (Ingvartsen, 2006) [8]. As per the current investigation, the level of serum glucose showed a transient fall which might be attributed with development of foetus and mobilization of maternal glucose to foetal blood circulation during advanced pregnancy, intense need of glucose for milk sugar synthesis and inadequate gluconeogenesis during early lactation phase (Jacob and Vadodaria, 2001) [9].

Gir cows showed decreased serum total protein and serum albumin ($p<0.05$) during post-partum period in as compared to control animals and pre-partum period. Shareef, (2020) [23] also recorded the similar findings. Reduction in serum total protein and albumin also noticed during pre-partum period than the control group, although changes were non-significant. A sharp decline in total serum protein concentration just one to two days before and after calving might be attributed to demand of more proteins for the production of milk and colostrum immunoglobulins (Mohri *et al*., 2007) [13]. Lower albumin levels may also be the result of impaired liver functioning detected in cows with hepatic lipidosis immediately following parturition (Radostits *et al*., 2009) [18]. According to (Gutyj *et al*., 2017) [7], a substantial decrement in serum albumin value may also indicate insufficiency of amino acid and protein.

The levels of blood urea nitrogen was found increased ($p<0.05$) in post-partum period as compared to pre-partum and healthy control group. These findings are in support with Sateesh *et al*. (2018) [22]. High blood urea nitrogen level

in lactating animals might be due to catabolism of muscle protein when huge amount of body reserves are utilized to meet the lactation requirements (Sreedhar *et al*., 2013) [26].

The serum calcium was declined (p<0.01) in Gir cows during peri-parturient period as compared to control animals. There was also significant variation between pre-partum and post-partum period in Gir cows. Vasantha *et al*. (2020) [28] also found lowered serum calcium in peri-parturient animals. Disturbance in homeostatic mechanism of calcium, high requirement for foetus and drain of calcium in the colostrum might contribute to hypocalcaemia (Sreedhar *et al*., 2013) [26].

Reduction in serum phosphorus was also significant (p<0.01) during peri-parturient period in comparison with control animals. Although, there was non-significant decline in serum phosphorus values between pre-partum and post-partum group. Results of present investigation are in agreement with Pal and Bhatta (2013) [15].

The lower level of serum phosphorus in peri-parturient cows might be due to high requirement for the foetal growth during advanced pregnancy and elevated outflow of phosphorus in colostrum and milk.

Serum magnesium was significantly dropped in the post-partum period in Gir cows (p<0.01) as compared to healthy control and pre-partum animals. However, non-significant reduction in serum magnesium was found between healthy control animals and pre-partum Gir cows. Similar results were also observed by Ghanem *et al*. (2012) [6] and Sateesh *et al*. (2018) [22].

Table 1: Mean ± SE values of various haematological parameters in control animals and peri-parturient Gir cows.

Parameter	Control group	Pre-partum	Post-partum
Haemoglobin(Hb)*	11.23^{b}±0.20	11.09^{ab}±0.16	10.61^{a}±0.16
Packed cell volume (PCV)*	34.22^{b}±0.66	32.21^{b}±0.53	31.74^{a}±0.59
Total erythrocyte count (TEC)*	7.31^{b}±0.23	6.73^{a}±0.16	6.55^{a}±0.12
Total leucocyte count (TLC)**	10.98^{c}±0.20	9.91^{a}±0.11	10.45^{b}±0.16
Platelet count	293.4±23.63	340.3±23.73	288.9.±17.41
Lymphocytes*	58.5^{b}±1.21	55.45^{a}±0.99	54.15^{a}±1.00
Neutrophils*	31.3^{a}±1.39	35.7^{b}±1.12	36.05^{b}±1.02
Monocytes	4±0.39	3.8±0.24	4.25±0.34
Eosinophils	4.8±0.49	3.95±0.36	4.35±0.36
Basophils	1.4±0.22	1.1±0.20	1.2±0.18

Means with different superscripts differ significantly
* Significant at 5% level (p<0.05)
** Significant at 1% level (p<0.01)

Table 2: Mean ± SE values of various biochemical parameters in control animals and peri-parturient Gir cows.

Parameter	Control group	Pre-partum	Post-partum
Serum glucose**	59.5^{c}±1.75	37.75^{b}±1.43	32.55^{a}±1.30
Serum total protein*	7.15^{b}±0.20	6.94^{b}±0.11	6.46^{a}±0.18
Serum albumin *	3.42^{b}±0.10	3.34^{b}±0.07	3.10^{a}±0.08
Serum blood urea nitogen*	10.80^{a}±0.51	11.4^{a}±0.40	12.65^{b}±0.49
Serum calcium (Ca)**	10.23^{c}±0.17	9.62^{b}±0.15	7.93^{a}±0.17
Serum phosphorous (P)**	5.71^{b}±0.29	3.95^{a}±0.17	3.76^{a}±0.15
Serum magnesium(Mg)**	2.88^{b}±0.04	2.79^{b}±0.04	2.5^{a}±0.10

Means with different superscripts differ significantly
* Significant at 5% level (p<0.05)
** Significant at 1% level (p<0.01)

Conclusion

In summary, peri-parturient dairy Gir cows revealed decreased haemoglobin, haematocrit and total red blood cell count on haematological analysis. There was leukocytosis accompanied by neutrophilia and lymphopenia, while Non-significant differences were observed in platelet count, monocyte, eosinophil and basophil count during peri-parturient period as compared to control group. Among biochemical parameters, significant reduction in serum glucose, serum calcium, phosphorus and magnesium was found. However, serum total proteins and albumin were also markedly reduced. The level of blood urea nitrogen was increased in Gir cows during the post-partum stage. It was concluded that during peri-parturient period, the cow's body go through a number of physiological adjustments that cause noticeable alterations in their haemato-biochemical profile.

References

1. Abdelrazek H, Ismail TA, El-Azzazi FE, Elsayed DH. Hematological and metabolic alterations in Egyptian buffaloes during transition period. Egypt. Acad. J Biol. Sci. C, Physiology and Molecular Biology. 2018;10(1):69-78.
2. Ambica G, Rao DS. Haemato biochemical and therapeutic studies on subclinical hypocalcaemia in crossbred cows. Int. J Pharma Bio Sci. 2012;3(4):225-231.
3. Amle M, Patodkar V, Shelar R, Birade H. Serum biochemical levels of repeat breeder cross bred cows under rural condition of Satara District of Maharashtra. Int. J Adv. Vet. Sci. Technol. 2014;3(1):109-113.
4. Detilleux JC, Koehler KJ, Freeman AE, Kehrli Jr ME, Kelley DH. Immunological parameters of periparturient Holstein cattle: genetic variation. J Dairy Sci. 1994;77(9):2640-2650.
5. Djoković R, Kurćubić V, Ilić Z, Cincović M, Petrović M, Fratrić N, *et al*. Evaluation of metabolic status in Simmental dairy cows during late pregnancy and early lactation. Vet Arhiv. 2013;83(6):593-602.

6. Ghanem MM, Mahmoud ME, Abd El-Raof YM, El-Attar HM. Metabolic profile test for monitoring the clinical, haematological and biochemical alterations in cattle during peri-parturient period. Benha Vet. Med. J. 2012;23:13-23.
7. Gutyj B, Grymak Y, Drach M, Bilyk O, Matsjuk O, Magrelo N, *et al*. The impact of endogenous intoxication on biochemical indicators of blood of pregnant cows. Regul. Mech. Biosyst. 2017;3(8):438-443.
8. Ingvartsen KL. Feeding-and management-related diseases in the transition cow: Physiological adaptations around calving and strategies to reduce feeding-related diseases. Anim. Feed Sci. Technol. 2006;126(3-4):175-213.
9. Jacob N, Vadodaria VP. Levels of glucose and cortisol in blood of Patanwadi ewes around parturition. Indian Vet. J. 2001;78(10):890-892.
10. Joshi KR, Pathan MM, Madhira SP, Pande AM, Dhusa DD. Study of haematological parameters of crossbred cows during peripartum period. Int. J Curr. Microbiol. App. Sci. 2018;7(12):461-467.
11. Kramer JW. Normal hematology of the horse. In: Feldman BF (ed) Schalm's veterinary hematology. Williams & Wilkins, Philadelphia. 2000, 1069-1074.
12. Kumar B, Pachauri SP. Haematological profile of crossbred dairy cattle to monitor herd health status at medium elevation in Central Himalayas. Res. Vet. Sci. 2000;69(2):141-145.
13. Mohri M, Sharifi K, Eidi S. Hematology and serum biochemistry of Holstein dairy calves: age related changes and comparison with blood composition in adults. Res. Vet. Sci. 2007;83(1):30-39.
14. Pal P, Acharya HR. Subclinical metabolic disorders in post-partum cross bred HF cattle in central part of Nepal. Int. J. Pharm. Med. and Bio. Sci. 2013;2(2):57-62.
15. Pal P, Bhatta R. Determination of blood metabolites in cross HF cattle at pre-parturient Stage: reference value. Int. J. Pharm. Med. and Bio. Sci. 2013;2(1):53-57.
16. Patel B, Kumar N, Jain V, Kumar F, Ajithkumar HM, Naik MA, *et al*. Haematological status of Karan Fries cows during transition period in hot humid condition. Int. J. Sci. Environ. Technol. 2017;6:793-797.
17. Puppel K, Kuczyńska B. Metabolic profiles of cow's blood; a review. J Sci. Food Agric. 2016;96(13):4321-4328.
18. Radostits OM, Gay CC, Blood DC, Hinchcliff KW. In: Veterinary Medicine: A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses. 10th edition, W.B. Saunders Elsevier Publisher, London, 2007.
19. Reddy BS, Sivajothi S. Assessemnet of haemato-Biochemical and stress parameters during the transition period in buffaloes. Buffalo Bull. 2020;39(2):161-165.
20. Reynolds CK, Aikman PC, Lupoli B, Humphries DJ, Beever DE. Splanchnic metabolism of dairy cows during the transition from late gestation through early lactation. J Dairy Sci. 2003;86(4):1201-1217.
21. Roy S, Roy M, Mishra S. Hematological and biochemical profile during gestation period in Sahiwal cows. Vet. World. 2010, 3(1).
22. Sateesh AG, Vivek KR, Patil NA, Bhoyar RG, Vivek MP, Shivaprakash BV. Study on metabolic profile of Deoni cows in transition Period. Pharma Innov. J. 2018;7(1):299-302.
23. Shareef AB, Luaibi OK. Clinical and Biochemical Profile of Iraqi Local Breed Cows During Pregnancy and Early Lactation. Iraqi J Vet. Med. 2020;44(E0):51-56.
24. Singh R, Randhawa SN, Randhawa CS, Chhabra S, Singh G. Baseline values for various metabolic parameters in crossbred dairy cows during periparturient period. J Entomol. Zool. Stud. 2020;28(3):1859-1863.
25. Singh R, Randhawa SN, Randhawa CS. Oxidative stress, Hemato-biochemical and plasma mineral profile in transition buffaloes. Proceedings of the National Academy of Sciences, India Section B: Biol. Sci. 2017;87(4):1091-1099.
26. Sreedhar S, Rao KS, Suresh J, Moorthy PR, Reddy VP. Changes in haematocrit and some serum biochemical profile of Sahiwal and Jersey× Sahiwal cows in tropical environments. Vet. Archive. 2013;83(2):171-87.
27. Sundrum A. Metabolic disorders in the transition period indicate that the dairy cows' ability to adapt is overstressed. Animals. 2015;5(4):978-1020.
28. Vasantha SK, Tej NK, Saikiran BV, Lavanya S, Sivaiah K, Mutha Rao M, *et al*. Hematological and biochemical changes in Ongole cows one week before and one week after parturition in relation to THI. Pharma Innov J. 2020;9(1):318-324.
29. Cochran D. Culture History of Indiana. Ball State University, Muncie, IN. 2004.