International Journal of Livestock Research, Vol. 10 (10) Oct' 2020
http://www.ijlr.org
eISSN: 2277-1964
NAAS Rating 2020 – 5.36

Original Research

Study of Biochemical Changes During Peri-Partum Period in Crossbred (Kankarej X Holstein Friesian) Cows

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How to cite this paper: yadav, A., Pathan, M., Madhira, S., & Pande, A. (2020). Study of biochemical changes during peri-partum period in crossbred (kankarej X Holstein Friesian) cows. *International Journal of Livestock Research*, 10(10), 152-157. doi: http://dx.doi.org/10.5455/ijlr.20200622111323

Received : Jun 22, 2020
Accepted : Aug 27, 2020
Published : Oct 31, 2020

Abstract

The whole study was conducted on six adults pregnant, apparently healthy, crossbred cows during the peripartum period i.e. from 45 days before parturition to 45 days after parturition. Nine ml of whole blood from each experimental animal was collected from the jugular vein in heparinized vacutainers. Plasma biochemical estimation was carried out using Diagnostic kits. The values of Glucose, BUN, Uric acid, Creatinine, Cholesterol and Total proteins were influenced significantly (P<0.05) by the physiological changes occurring during the peri-partum period in the crossbred cows.

Keywords: Biochemical, Cow, Parturition

Introduction

The transition (or periparturient) period is the most critical period in dairy cows regarding health status and production. It constitutes late pregnancy and early lactation, generally 3 weeks before to 3 weeks after parturition (Grummer 1995). Parturition and the onset of lactation represent periods of drastic physiological changes and intense metabolic demands in dairy cows. Haematological and biochemical changes also occur particularly during this transition period. Various factors influence a metabolic profile in animals. Haematological and Biochemical indices are the most reliable indicators of metabolic activity and health status of dairy cows (Block, 2010). Immediately after calving, animals undergo severe negative energy balance, indicated by alterations in blood metabolites and hormone profiles (Wathes *et al.*, 2009). A combination of hormones from the fetus, placenta and dam induce a series of events leading to parturition and also responsible for altered biochemical profile (Rhodes, 2003).

Relatively, little is known about the fundamental biological processes during the peripartum period particularly in crossbred cattle. In view of the above facts an investigation was planned on Crossbred cows during their peripartum period.

Material and Methods

The whole study was conducted on six adult pregnant, apparently healthy, Crossbred cows during Peripartum period i.e. from 45 days before parturition to 45 days after parturition. The research was approved by the Institutional animal Ethics Committee (IAEC.No.235/VBC/2016). The experimental animals were reared in semi-open housing system which is made up of concrete floor under asbestos roofed housing system constructed east west direction and well covered with trees. These experimental cows were not separated from other cows. The experimental animals were maintained on ICAR feeding standard (1998).

Nine ml of whole blood from each experimental animal was collected from jugular vein in heparinized vaccutainer. The blood was collected from 45 days before parturition at weekly interval i.e. -45day, -38day, -31day, -24day, -17day, -10day, -3 day, on the day of parturition and up to 45 days after parturion i.e. on +3day , +7day, +10day, +15day,+30day and +45day in accordance with the probable date of parturition. Plasma from the blood samples was separated by centrifugation at 3000rpm for 15 minutes and stored in deep freeze at -20◦C until analyzed for biochemical parameters. This plasma biochemical estimation was carried out in the Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand using Diagnostic kits manufactured by Crest Biosystems, Coral Clinical Systems, Goa, by Spectrophotometer (model Visiscan 167). The data obtained in the present study was statistically analyzed by the Completely Randomised Design (CRD). Statistical analysis performed at Department of Agriculture Statistics, B. A. College of Agriculture, Anand Agricultural University, Anand.

The statistical model for CRD with one observation per unit

$Yij = \mu + ti + eij$
μ = overall mean effect
ti = true effect of the ith treatment
eij = error term of the jth unit receiving ith treatment

Result and Discussion

Serum biochemical parameters assume special significance in animals due to their role in body homeostasis, thus providing vital clues on the body's response to disease and production. Pregnancy and lactation are physiological status considered to modify metabolism in animals and induce stress (Tanritanir *et al.*, 2009). Mean±SE values of all Biochemical parameters were presented in Table 1. The observed overall mean value of glucose (mg/dl) in crossbred cows was 74.62 ± 3.66 which range from 51.31 ± 2.94 to 93.16 ± 8.26 during the peripartum period. Glucose level was significantly ($P<0.05$) decreased on day of parturition as compared to all peri-partum days. Glucose level was decreased non-significantly from 45 days before to 31 days before calving. On 24 days before calving the glucose level was significantly ($P<0.05$) lower as compared to other pre-partum days.

Table 1: Mean (±SEM) values of biochemical parameters in crossbred cows (n=6) during peripartum period

Days	Glucose (mg/dl)	Blood Urea Nitrogen (mg/dl)	Uric acid (mg/dl)	Cholesterol (mg/dl)	Creatinine (mg/dl)	Total Proteins (g/dl)
-45	$93.16^{a} \pm 8.26$	$16.10^{e} \pm 0.83$	0.51± 0.064	$185.53^{a} \pm 26.75$	0.80 ± 0.14	$7.77^{a} \pm 0.21$
-38	$88.28^{ab} \pm 9.34$	$16.13^{e} \pm 1.00$	0.47 ± 0.09	$141.76^{bc} \pm 26.97$	0.87 ± 0.19	$7.68^{a} \pm 021$
-31	$85.44^{abc} \pm 12.13$	$16.98^{de} \pm 0.85$	0.33 ± 0.054	$123.55^{bcd} \pm 20.1$	1.40 ± 0.24	$7.46^{ab} \pm 0.16$
-24	$68.57^{ef} \pm 8.81$	$17.96^{cd} \pm 0.64$	0.40 ± 0.11	$123.38^{bcd} \pm 23.85$	1.28 ± 0.30	$6.86^{bc} \pm 0.21$
-17	$81.15^{abcd} \pm 8.73$	$19.49^{bc} \pm 1.89$	0.41 ±0.08	$116.76^{cde} \pm 13.77$	0.85 ± 0.16	$6.82^{bc} \pm 0.29$
-10	$75.62^{cdef} \pm 7.77$	$18.30^{cd} \pm 0.95$	0.31 ± 0.08	$86.58^{ef} \pm 10.25$	0.57 ± 0.08	$6.15^{cd} \pm 0.20$
-3	$72.78^{def} \pm 7.71$	$18.09^{cd} \pm 1.52$	0.50 ± 0.12	$76.08^{f} \pm 11.18$	0.78 ± 0.12	$5.77^{d} \pm 0.14$
0	$44.97^{g} \pm 3.84$	$22.81^{a} \pm 0.95$	0.30 ± 0.05	$41.49^{g} \pm 3.03$	1.01 ± 0.29	$5.06^{e} \pm 0.10$
3	$51.31^{g} \pm 2.94$	$19.93^{b} \pm 0.79$	0.35 ± 0.06	$62.89^{fg} \pm 13.33$	1.01 ± 0.16	$5.64^{de} \pm 0.12$
7	$64.32^{f} \pm 4.90$	$20.23^{b} \pm 0.88$	0.48 ± 0.10	$94.03^{def} \pm 14.87$	0.84 ± 0.30	$6.35^{cd} \pm 0.15$
10	$81.06^{abcd} \pm 8.27$	$19.95^{b} \pm 1.00$	0.49 ± 0.07	$143.04^{bc} \pm 24.23$	1.13 ± 0.38	$6.78^{bc} \pm 0.24$
15	$74.06^{cdef} \pm 6.72$	$18.71^{bc} \pm 1.30$	0.37 ± 0.08	$132.22^{bc} \pm 16.32$	1.05 ± 0.20	$7.19^{ab} \pm 0.33$
30	$77.70^{bcde} \pm 8.60$	$19.47^{bc} \pm 0.84$	0.52 ± 0.12	$146.80^{bc} \pm 14.32$	1.16 ± 0.29	$7.28^{ab} \pm 0.23$
45	$86.33^{abc} \pm 9.36$	$20.13^{c} \pm 1.08$	0.60 ± 0.23	$154.09^{ab} \pm 14.79$	1.03 ± 0.16	$7.94^{a} \pm 0.12$
GM	74.62 ± 3.66	18.80 ± 0.48	0.43 ± 0.02	116.30 ± 10.56	0.98 ± 0.05	6.77 ± 0.23
CD	22.58	2.68	NS	50.68	NS	0.59
CV %	26.28	12.33	59.47	37.85	58.5	7.57

Values having different superscripts differed significantly (P < 0.05) within column

On the day of parturition, the glucose level was significantly (P<0.05) decreased as compared to all peri-partum days. The value of glucose increased after parturition but the significant (P<0.05) increase in glucose was observed from day 10 onwards reaching the pre-partum levels by day 45. Results of present experiment were in consonance with observations of Kennerman and Kaya (2004) in Holstein cows, Oniia and Colibar (2009) in HF cows, Djokovic *et al.* (2013) and Yehia and Salem (2015) in dairy cows. However, Roy et al. (2010) in cows, Khan *et al.* (2011) in Murrah Buffaloes and Abdulkareem (2013) in Iraqi riverine buffaloes observed non- significant differences in levels of glucose. While, Ashmawy (2015) reported significant increase in Glucose levels around parturition in buffaloes and cows.

The blood glucose level is regarded as one of the indicators of energy status in the cows. The concentration of glucose decreases in the first and second week of lactation. A temporary fall in the level of glucose in first weeks of lactation is a consequence of increased synthesis of lactose and decreased gluconeogenesis. The decrease in blood glucose concentration recorded in this study around parturition may be attributed to several hormonal changes which occur mainly to adjust the parturition and lactation requirements and particularly to regulate body metabolism leading to postpartum hypoglycemic state. The observed overall mean value of blood urea nitrogen (BUN) (mg/dl) in crossbred cows was 18.80 ± 0.48, which range from 16.10 ± 0.83 to 22.81 ± 0.95during the peripartum period. Highest level of BUN was observed on the day of calving as compared to all other peri-partum days. The BUN levels did not differ significantly upto calving except on 17 days before on which the levels slightly increased than any other day pre-partum. On the day of parturition, the level of BUN were significantly higher (P<0.05) than any other peri-partum days. After parturition the BUN level was significantly (P<0.05) decreased from day 7 onwards to day 45. Results of present experiment were in consonance with observations of Tanaka *et al.* (2011) in dairy cows and Piccione *et al.* (2012) in HF cows. However, Campos *et al.* (2012) observed non- significant differences in BUN levels in Harton Del Valle and Holstein cows during transition period. While, Khan *et al.* (2011) in Murrah buffaloes reported significantly lower levels of BUN on calving during summer.

As reported in the current study the slight elevation of urea levels during last phase of gestation and early lactation could be related to enhancement of metabolic activities which induce an increase in protein catabolism. In late gestation glucose availability for oxidation is supplemented by increased catabolism of amino acids at the expense

of protein synthesis, thus increasing urea production. (Bell 1995). The observed overall mean value of uric acid (mg/dl) in crossbred cows was 0.43 ± 0.02 which range from 0.30 ± 0.05 to 0.60 ± 0.22 during the peripartum period. No significant difference was found in Uric acid levels during the peri-partum period. The values of uric acid were non-significantly high on day 45 and day 3 before and 45 days after calving. The value of uric acid was decreased non- significantly on the day of parturition. Similar type of results was observed by Palacios *et al.* (2017) in crossbred goats. Whereas, Damgaard *et al.* (2013) showed a decreased level of uric acid in first week postpartum in Holstein dairy cows and Karimi *et al*. (2016) showed a decrease in uric acid level after calving in dairy cows.

Uric acid is a constituent of urine nitrogen losses. In this regard, increased values of uric acid indicate the kidney damage (Cornelius 1989), while in contrast low concentrations are related to dietary energy and protein levels (Mohammed *et al.*, 2016). In this study the values of uric acid were not affected by the physiological status and remained in the range which is considered normal. This result indicates that nutritional management of the cows was appropriate according to their physiological status.

The observed overall mean value of cholesterol (mg/dl) in crossbred cows was 116.30 ± 10.56 which range from 41.49 ± 3.03 to 185.53 ± 26.75 during the peripartum period. Cholesterol level was significantly ($P<0.05$) decreased on day of parturition as compared to all peri-partum days. Cholesterol level was highest 45 days before calving and the level started declining significantly ($P<0.05$) from 31 days before to the day of parturition. It was observed a significantly lowest level of cholesterol at calving as compared to other peri-partum days. After parturition the cholesterol level started increasing significantly ($P<0.05$) from 7 to 45 days.

Results of present experiment were in consonance with observations of Singh *et al.* (2012) in Murrah buffaloes, Piccione *et al.* (2012) in HF cows and Yehia and Salem (2015) in dairy cows. However, Abdulkareem (2013) had observed non- significant differences in Cholesterol levels in Iraqi riverine buffaloes. While, Oniia and Colibar (2009) reported significantly high level of cholesterol during one week after parturition which was gradually increased up to 41 days post-partum in HF cows. The cholesterol concentration was observed to be significantly affected by the physiological phase in this study. Characteristic changes in lipid metabolism were found during pregnancy and lactation in most mammals (Roche *et al.*, 2009). Endocrine profiles changes and lipolysis and lipogenesis are regulated to increase lipid reserve during pregnancy and subsequently, these reserves are utilized following parturition and the initiation of lactation (Roche *et al.*, 2009). The increased demand of steroid hormone to face the fetal tissue requirement and the maternal glands is considered the primary cause to decrease the serum total cholesterol concentration in last phase of pregnancy in dairy cattle. The serum total cholesterol concentration was minimum following calving and got build up as the lactation progressed as reported by Grummer (1993). The higher level of cholesterol with advancement of lactation was a physiological adjustment to meet the lactation requirements.

The observed overall mean value of creatinine (mg/dl) in crossbred cows was 0.985 ± 0.059 which ranged from 0.57 ± 0.08 to 1.40 ± 0.24 during the peripartum period. No significant differences were found in creatinine levels during the peri-partum period. The values of creatinine were non-significantly high on 31 days before and low on 10 days before parturition.

Singh *et al.* (2014) observed decreased level of creatinine during the lactation period in crossbred cows. Whereas, Ghanem *et al.* (2012), observed significantly ($P<0.05$) higher level of creatinine value during peri-parturient period in Friesian cows. Piccione *et al.* (2012) in Holstein Friesian cows also observed decreased creatinine levels during the post-partum period. While Yokus and Cakir (2006) observed that creatinine value does not differ with reproductive status. The concentration of creatinine in the blood has been directly related to muscle mass, as it is a product of muscle metabolism and, as a result, is significantly correlated to live weight. So, the increase in serum creatinine levels could be attributed to the development of the foetal musculature, which is well documented in sheep and ewes too (Roubies *et al.*, 2006). Low concentration of creatinine is dependent on dietary intake of energy and protein levels (Mohamed *et al.*, 2016) as well as tissue protein catabolism. No changes in the levels of values indicate that the nutritional management is appropriate according to the physiological status of the animal.

The observed overall mean value of total proteins (g/dl) in crossbred cows was 6.77 ± 0.23 which range from 5.06 ± 0.10 to 7.77 ± 0.21 during the peripartum period. Total proteins level was significantly ($P<0.05$) decreased on day of parturition compared to any other peri-partum day. Total proteins value was significantly ($P<0.05$) high on 45 days before and started declining significantly ($P<0.05$) from 38 days before calving. Lowest level of total protein

was observed on the day of calving as compared to any other peri-partum day. After parturition the total protein value started to increase significantly (P<0.05) from day 7 reaching the pre-partum values by day 45.

Results of present experiment were in consonance with observations of Oniia and Colibar (2009) in HF cows, Piccione *et al.* (2012) in HF cows, Mohamed *et al.* (2015) in Buffalo heifers and Yehia and Salem (2015) in dairy cows. However, Abdulkareem (2013) observed non- significant differences in total protein levels in Iraqi riverine buffaloes. While, Ashmawy (2015) reported that total protein concentration increased around parturition in buffaloes and cows. In this study, the total serum protein levels were significantly affected by the physiological changes and increased during lactation if compared to late gestation. The variations reflect the maternal requirements of protein needed for milking and providing immunoglobulins (Roubies *et al.*, 2006; Bell *et al.*, 2000).

Conclusion

Among biochemical constituents, concentration of glucose, Cholesterol and total protein were decreased significantly (P < 0.05) on the day of parturition. BUN concentration was significantly (P < 0.05) elevated on the day of parturition. The concentration of uric acid and creatinine were not differed significant between pre-partum and post-partum period. The values of biochemical parameters (Glucose, BUN, Uric acid, Creatinine, Cholesterol and Total proteins) were influenced significantly (P<0.05) by the physiological changes occurring during the peri-partum period in the crossbred cows.

Acknowledgements

The authors are thankful to the College of Veterinary Science & Animal Husbandry and Anand Agricultural University for providing financial assistance for this research.

Conflict of Interests

There is no conflict of interest.

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