SEASONAL VARIATIONS IN BLOOD METABOLIC PROFILES DURING PERI AND EARLY POSTPARTUM PERIOD IN WINTER AND SUMMER CALVED BUFFALOES

W. D. ABAYAWANSA[1], S. PRABHAKAR[2*], A. K. SINGH[3] AND P. S. BRAR[4]

Department of Veterinary Gynaecology and Obstetrics

Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana - 141 004

Received : 29.12.2011 Accepted : 05.05.2014

ABSTRACT

The present study was conducted on healthy, lactating pluriparous Murrah buffaloes (n = 29), calved during December 2007 to May 2008. On the basis of season of calving the animals were divided into two group's viz. winter calving buffaloes (WCB) and summer calving buffaloes (SCB). During postpartum period, WCB had significantly ($P < 0.05$) higher blood concentration of total protein, urea nitrogen and non-esterified fatty acids whereas SCB had significantly ($P < 0.05$) higher concentration of glucose, cholesterol and creatinine. Overall, fluctuations in the mean concentration of various metabolic parameters were noticed in buffaloes of both the groups.

Key words: Blood metabolic profile, Buffalo, Calving, Season.

INTRODUCTION

High yielding dairy cows undergo a varying period of a state of negative energy balance during early postpartum phase (Bauman and Currie, 1980). Changes in endocrine and metabolic milieu of early lactation due to negative energy balance adversely affect postpartum reproduction (Peter *et al.*, 2009). Elevated levels of non-esterified fatty acids (NEFA), urea nitrogen and glucose in blood are mainly responsible for poor reproductive efficiency during early postpartum period (Roche, 2006). The main effect of postpartum negative energy balance occurs at the hypothalamic level and is manifested by altered endocrine levels and ovarian functions (Butler *et al.*, 2006). Previous studies have been undertaken in buffaloes to estimate some of the above mentioned factors in blood and their effects on postpartum reproduction (Shah *et al.*, 2003). However, gaps still exist for further clarification of basic metabolic profile during early postpartum period in buffaloes in varying seasons. Therefore, further investigation on this aspect needs to be elucidated in buffaloes during early lactation. The present study was conducted with the objective to seasonal variation in blood metabolic factors in winter and summer calving buffaloes during peri- and early postpartum period.

MATERIALS AND METHODS

Healthy, lactating pluriparous Murrah buffaloes (n = 29), in their third to fifth parity and calved during December 2007 to May 2008 were selected at two organized dairy farms (Government Buffalo Breeding Farm, Mattewara and dairy farm of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana). They were categorized as winter calved buffaloes (WCB; n = 19) and summer calved buffaloes (SCB; n = 10). All the animals were maintained under standard managemental and hygienic conditions. They were fed *ad lib* with seasonal green fodder, wheat straw and concentrate mixture. They were milked twice a day, morning (4.00 am) and evening (4.00 pm). Late pregnant animals were kept separate until calving.

Present Address: [1]Animal Breeding Division, Department of Animal Production and Health, Gatambe, Peradeniya, Sri Lanka

[2*]Professor of Obstetrics (Corresponding author), E-mail: sp1962@yahoo.com

[3]Assistant Professor

[4]Professor of Gynaecology

Blood samples were collected at weekly intervals, two weeks prior to calving up to nine weeks postpartum. All the samples were centrifuged at 3000 rpm for 15 min, plasma harvested and stored at -20°C until assayed.

Plasma glucose, total serum protein and serum urea nitrogen concentrations were measured by enzymatic colorimetric test. Plasma creatinine concentration was measured by the picrate method. The above parameters were measured by using commercially available kits (Autopak, Bayer Diagnostic India Ltd.). Plasma non-esterified fatty acids concentration was estimated by the method of Lowry and Tansley (1976), after extraction of plasma total lipids.

The differences between WCB and SCB for various blood parameter changes were tested using 2 x 2 analysis of variance (ANOVA) with significant interactions at 5% level. The significant interactions were tested using Duncan's multiple range test. Difference in mean ($\overline{X}$ ± SEM) metabolic indices in the two groups was subjected (Students 't' test) to the methods described previously (Zar, 2008).

RESULTS AND DISCUSSION

Weekly variation in metabolic factors in blood of WCB and SCB has been shown in figure 1.

In both the groups, an elevated concentration of plasma glucose was observed on the day of calving. After calving, the average concentration of plasma glucose for each week was higher ($P < 0.05$) in SCB than in WCB. This seasonal variation in plasma concentration of glucose could be due to the stress induced changes owing to unfavorable environment. Reduced peripheral utilization of glucose and gluconeogenesis may be responsible for higher glucose levels. The present finding was in agreement with that of Ingvartsen and Andersen, (2000) who reported that the plasma glucose concentration increased during the last week of pregnancy and decreased suddenly after calving in dairy cows to reach the minimum concentration during first 3 weeks postpartum.

During the study period, the mean total protein concentration was 7.4 ± 0.1 and 6.8 ± 0.1 g/dl in winter and summer calving buffaloes, respectively. In both the groups, the serum total protein concentration dropped one week prior to calving, increased on the day of calving and again displayed a fall at day 7 postpartum. Similar findings were reported by Abdul *et al.* (2003) who recommended that the sudden decline one week before calving, increase around calving and decline one week after calving in total plasma protein could be due to reduction in globulin and albumin fraction and increase in immunoglobulin content in blood, respectively. Gadhave *et al.* (2000) suggested that the low concentration of serum total proteins in summer calving buffaloes could be due to adverse effect of environment and inappropriate feeding. The observations in the present study indicated that dietary supplementation with proteins should be appropriate to minimize losses due to production and have normal reproduction.

The overall mean concentration was 75.9 ± 2.9 mg/dl in WCB and 82.0 ± 3.3 mg/dl in SCB. A significantly ($P < 0.05$) higher serum cholesterol concentration was noticed during the pre-calving period in WCB than in SCB (65.6 ± 1.8 mg/dl vs 54.8 ± 4.4 mg/dl) which decreased continuously till calving in both the groups. After calving, SCB had higher weekly concentration of serum cholesterol than their counterparts. The low concentration of serum cholesterol at calving in both the groups could be due to high demand for adrenal corticosteroid and placental steroid synthesis as well as colostrum and milk synthesis. Umesh *et al.* (1995) found increased concentration of plasma cholesterol in summer calving buffalo after calving and attributed it to be due to the effect of heat stress associated with high production of stress hormones.

The mean SUN concentration was 24.6 ± 3.9 mg/dl and 22.4 ± 3.4 mg/dl in WCB and SCB, respectively. While the pre-calving values were higher in SCB (21.6 ± 1.3 mg/dl vs 19.9 ± 0.5 mg/dl), post-calving levels were elevated in WCB (26.5 ± 2.1 mg/dl vs 22.9 ± 3.8

mg/dl;). Qureshi *et al.* (2002) found that the SUN level was higher in buffaloes that calved in normal breeding season than in buffaloes that calved in low breeding season (39.4 mg/dl vs 31.7 mg/dl). The SUN concentration declined continuously from 2 weeks prior to calving until calving in WCB and in a similar manner till week one postpartum in SCB. Thereafter, in both the groups, there was a gradual rise in concentration of SUN till 9 weeks postpartum. Westwood *et al.* (2000) reported that cows fed with high than low amount of rumen-degradable proteins during early lactation had higher concentration of plasma urea concentration (9.0 mmol/l vs 8.5 mmol/l). A high amount of protein rich diet fed during early postpartum period might have caused increased concentration of SUN over the period of study.

The mean serum creatinine concentration was 2.2 ± 0.5 mg/dl in SCB and 1.7 ± 0.5 mg/dl in WCB. Both pre-calving (2.2 ± 0.4 mg/dl vs 1.8 ± 0.5 mg/dl) and post-calving concentrations (2.0 ± 0.5 mg/dl vs 1.7 ± 0.5 mg/dl) were non-significantly higher in SCB than WCB. The pattern and concentration of serum creatinine exhibited a variable and fluctuated response throughout the study period in both the groups. In SCB, serum creatinine concentration declined from 2 weeks prepartum till one week postpartum. It was maintained at low levels till week six postpartum with a gradual rise thereafter. In WCB, there was a gradual rise till calving and thereafter it declined slowly. Heavy evaporation of water from the body during summer season, withdrawal of milk at the same time, limited access to drinking water, and scarcity of green fodder and lack of wallowing facility could be reasons for SCB to be severely dehydrated that resulted in elevated concentration of serum creatinine. In WCB, the maximum concentration of serum creatinine was recorded at calving. Heavy loss of body fluid at calving might increase the degree of dehydration and serum creatinine concentration (Reist *et al.*, 2002).

The mean concentration of plasma NEFA was higher in WCB than in SCB, both during prepartum (0.16 ± 0.06 µmol/ml vs 0.12 ± 0.02 µmol/ml) and postpartum periods (0.21 ± 0.02 µmol/ml vs 0.14 ± 0.04 µmol/ml). On the whole a higher overall mean concentration of NEFA was observed in WCB as compared to SCB during study period (0.19 ± 0.01 µmol/ml vs 0.14 ± 0.04 µmol/ml). Nevertheless, in both the groups, postpartum concentrations were higher than prepartum concentrations. A lower concentration of NEFA in the SCB could be attributed to the effect of heat stress and associated with high production of stress hormones. Smith *et al.* (2007) reported that plasma concentrations of NEFA were positively correlated with environment temperature.

From the above study it can be deduced that significant alterations in metabolic profile were noticed in both the summer and winter calving buffaloes during early postpartum period that can have impact on the subsequent postpartum production and reproduction.

REFERENCES

Abdul, G.L., Singh, C. and Sangha, S.P.S. (2003). Effect of advanced pregnancy and early lactation on the changes in protein profile of plasma in Murrah buffaloes. *Indian J. Anim. Sci.,* **73:** 1031-32.

Bauman, D.E. and Currie, W.B. (1980). Partitioning of nutrients during pregnancy and lactation: a review of mechanisms involving homeostasis and homeorhesis. *J. Dairy Sci.,* **63**: 1514-29.

Butler, S.T., Pelton, S.H. and Butler, W.R. (2006). Energy balance, metabolic status and the first postpartum ovarian follicle wave in cows administered propylene glycol. *J. Dairy Sci.,* **89:** 2938-51.

Gadhave, L.R., Mantri, A.M., Talvelkar, B.A. and Desmukh, B.T. (2000). Serum protein profile during gestation and early post-partum period in Gir and crossbred cows. *Indian Vet. J.,* **77:** 114-16.

Ingvartsen, K.L. and Andersen, J.B. (2000). Symposium: Dry matter intake of lactating dairy cattle. Integration of metabolism and intake regulation: A review focusing on periparturient animals. *J. Dairy Sci.,* **83:** 1573-97.

Lowry, R.R. and Tansley, T.J. (1976). Rapid colorimetric determination of free fatty acids. *J. Am. Oil Chem. Soc.*, **53:** 470-72.

Peter, A.T., Vos, P.L.A.M. and Ambrose, D.J. (2009). Review: Postpartum anestrus in dairy cattle. *Theriogenology,* **71:** 1333-42.

Qureshi, M.S., Habib, G., Samad, H.A., Siddiqui, M.M., Ahmad, N. and Syed, M. (2002). Reproduction-Nutrition relationship in dairy buffaloes. 1. Effect of intake of protein, energy and blood metabolites levels. *Asian-Aust. J. Anim. Sci.,* **15:** 330-39.

Reist, M., Erdin, D., Von, D., Tschuemperlin, K., Leuenberger, H., Chilliard, Y., Hammon, H.M., Morel, C., Philipona, C., Zbinden, Y., Kuenzi, N. and Blum, J.W. (2002). Estimation of energy balance at the individual and herd level using blood and milk traits in high-yielding dairy cows. *J. Dairy Sci.,* **85:** 3314-27.

Roche, J.F. (2006). The effect of nutritional management of the dairy cow on reproductive efficiency. *Anim. Reprod. Sci.,* **96:** 292-96.

Shah, R.G., Dhami, A.J., Patel, K.P., Patil, N.V. and Kavani, F.S. (2003). Biochemical and trace minerals profile in fertile and infertile postpartum Surti buffaloes. *Indian J. Anim. Reprod.,* **24:** 16-21.

Smith, K.L., Stebulis, S.E., Waldron, M.R. and Overton, T.R. (2007). Prepartum 2, 4-Thiazolidinedione alters metabolic dynamics and dry matter intake of dairy cows. *J. Dairy Sci.,* **90:** 3660-70.

Umesh, K.R., Reddy, V.S.C., Rao, A.S., Reddy, C.E., Reddy, V.S. and Reddy, G.V.N. (1995). Studies on certain blood constituents of rural buffaloes during cyclic and postpartum anoestrus periods. *Indian Vet. J.,* **72:** 469-71.

Westwood, C.T., Lean, I.J., Garvin, J.K. and Wynn, P. (2000). Effects of genetic merit and varying dietary protein degradability on lactating dairy cows. *J. Dairy Sci.,* **83:** 2926-40.

Zar, J.H. (2008). Biostatistical analysis. 4th Edn. Dorling Kindersley (India) Pvt. Ltd. Pearson Education. Delhi, India.