Differentiation of Post-partum Estrus and Non-estrus Stages of Dairy Animals on the Basis of Haematological Attributes

Saurabh Tiwari[1], Yajuvandra Singh[2], Rajneesh Sirohi[3], Brijesh Yadav[4], Deep Narayan Singh[5]

Author Affiliation: [1]PhD Scholar, [2,3,5]Assistant Professor, Department of Livestock Production Management, [4]Assistant Professor, Department of Veterinary, College of Veterinary Science & Husbandry, Mathura 281001, India.

Abstract

The present investigation was planned to differentiate various stages of estrus i.e. onset of estrus, standing heat and non-estrus conditions in sahiwal cows by observing various haematological attributes. The experiments were conducted on ten healthy, cyclic Sahiwal cows maintained at Livestock Farm Complex (LFC) of College of Veterinary Science & Animal Husbandry, DUVASU, Mathura. The selected Sahiwalcows were observed for signs and symptoms of heat/estrus. Detection of onset of post-partum estrus was performed by observing the first response of teaser bull and rectal palpation of cow at every 3 hours interval after onset of estrus. Blood sample was collected for haematological changes duringtheir onset of estrus, standing heat and non-estrus stages. The mean values for RBC (6.79±0.10 X106/mm3), WBC (10.65±0.18 X103/mm3), PCV (33.41±0.54%), and haemoglobin (11.47±0.15 mg/dl) of experimental cows were found to be significantly (P<0.01) higher during standing heat condition as compared to onset of post-partum estrus and non-estrus stages in Sahiwal cows. On the basis of above factshematological attributes (RBC count, WBC count, blood hemoglobin and PCV) may be used for precise identification of onset of estrus,standing heatand non-estrus stages in Sahiwal cows.

Keywords: Cyclic; Estrus; Hematology; PCV; Sahiwalcows.

Introduction

Dairying is an important secondary source of income for millions of rural families and is assumed to be the most important enterprise in providing employment and income generating opportunities, particularly, for women and marginal farmers in India. Animal husbandry is an economic enterprise & considered as "survival enterprise" for millions of people in India, especially Arid & Semi-Arid regions. Hence livestock is an engine for economic diversification, livelihood security and sustainable rural development of the country (Singh *et al., 2018*). Production performance of a herd largely depends upon ratio of wet and dry animals. Ideally, a dairy farm is considered to be economic when 66 to 75% of its herd strength remains always in milk. Productive and reproductive performance of dairy animals is largely affected by their nutritional and health statuses and various management practices.

Corresponding Author: Deep Narayan Singh, Assistant Professor, Department of Livestock Production Management, College of Veterinary Science & Husbandry, Mathura 281001, Uttar Pradesh, India.

E-mail: drdeep25@gmail.com

The reproductive efficiency of the dairy animals has a direct impact on productivity and profitability of dairy farms (Lobago *et al.,* 2007). Therefore, reproduction management is a major concern in dairy industry. To get maximum profitability from dairy industry there is a need of better reproductive management of dairy animals so that they must be in regular cycle and must be bred at definite intervals. So, the concept of timed AI must be followed which is only possible with the accurate detection of different stages of heat.

The postpartum period is regarded as important in the reproductive life of the cow because of its important effect upon future fertility (Fonesca et al. 1983; Oltenacu *et al.* 1983). It has been reported that the total blood leukocytecounts increase markedly on the day preceding the calving (Merrill and Smith 1954; Paterson 1957). Merrill and Smith (1954) found that lymphocyte, eosinophil numbers increased and neutrophils decreased while monocytes did not show any definite change up to 10 days postpartum. The mean blood total leukocyte and absolute blood lymphocyte counts as well as the neutrophil counts dropped sharply after parturition and then increased gradually toward the 20 days after parturition (Hussain and Danial 1992; Guidry et al. 1976). Saad *et al.* (1989) found that the number of blood lymphocytes decreased before and at parturition, returning to a higher level during the second week postpartum. Similar findings were made by the other investigators in cows. Regarding the mammary gland, extensive influx of neutrophils into the colostrums and milk occurs around calving and during the first week after calving (Guidry *et al.,* 1976; Straub *et al.,* 1959). Peripheral leukocyte count was not influenced by the reproductive state of cow; however, the mean neutrophil concentration was significantly different between the reproductive states (PCommunication of the timing of the physiological event of ovulation and coordination of sexual behavior are important for successful fertilization (Schams *et al.,* 1977; Ziegler *et al.,* 1993). The success rate of artificial insemination in cattle mainly depends on the time of estrus it is inseminated. Inefficient and inaccurate heat detection results in failure of conception during that attempt, which in turn leads to significant economic losses (Karir *et al.,* 2006). The efficient and accurate detection of estrus and the timing of AI has remained major challenge in improving reproductive and economic efficiencies of dairy farms (Heersche and Nebel, 1994). The detection rates of visual observation have been observed to be even below 50% at larger herd sizes (Van Eerdenburg *et al.,* 2002). Therefore, there is a need for adoption of improved technologies for accurate and timely detection of estrus so that dairy animals may be inseminated at the most appropriate time without missing even a single estrus cycle (Saint-Dizier and Chasant-Maillard, 2012). Therefore, keeping in view the above facts,the present study was carried out for the accurate identification of various stages of estrus.

Material and Method

The experiment was conducted at District Dairy Demonstration Farm (DDDF) within the premises of Livestock Farm Complex (LFC) of U.P. Pandit Deen Dayal Upadhayay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan (DUVASU), Mathura from the month of September 2018 to march, 2019.The elevation (altitude) of Mathura is 174 meters (570 feet) above the mean sea level and lies between 27^0-14' to 27^0-58' N longitude and 77^0-71' to 78^0-12' E latitude. The average annual rainfall of the farm varies between 532-620 mm. The climate is generally characterized as hot & dry during summers. The maximum temperature varies between 45 - 48^{0}C and the min. temperature goes as down as up to 2^{0}C during winters. The relative humidity of this farm varies from 18 to 79 percent. The study area falls under semi-arid conditions.

Ten healthy, cyclic, Sahiwal cows, which never expressed any reproductive abnormality in the past, were selected for the experiment. No heifer was selected as experimental animal in order to avoid the adverse effect of any type of congenital reproductive defects. No special management practice was followed for the experimental animals. They were kept along with their original herd mates in the same shed under loose housing system. The feeding and other management practices for these cows remained same as was normally practiced for other cows of the herd. The onset of estrus, standing heat and non-estrus stages of same individual was compared for differences in their haematological attributes. The selected cows were observed for signs and symptoms of heat/estrus. The first heat was missed and thereafter the animals were kept under close observation from 17th day onward of first heat for appearance of onset of second heat. Detection of onset of estrus was done by observing the first response of teaser bull to a cow. Thereafter, standing heat condition was identified by observing stand still or receptive stage of the cow to a teaser bull and it was confirmed by rectal palpation of cow at every 3 hours interval after onset of estrus.Approximately

10 ml blood sample was collected from jugular vein of each estrus cow during their onset of estrus, standing heat and non estrus stages. The blood samples were collected in heparinized vaccutainer tubes. A portion of collected blood sample was utilized for haematological examinations (total erythrocyte count, total leukocyte count, packed cell volumeandhaemoglobin concentration).

Result and Discussion

The results (Table 1) revealed a significant (P<0.05) effect of different stages of estrus on total erythrocyte count,total leukocyte count,packed cell volume and haemoglobin concentration of experimental Sahiwal cows. The overall pool mean for total erythrocyte count,total leucocytes count, PCV,hemoglobin concentration of experimental

Sahiwal cows in present study was observed to be 6.62±0.06X106 per mm3, 10.21±0.13X103 per mm3, 30.52±0.53% and 10.50±0.17 mg/dl, respectively, whereas the mean values fortotal erythrocyte count were observed to be 6.62±0.11X106, 6.79±0.10X106, 6.46±0.10X106 per mm3,total leucocytes count were 10.14±0.21 X103, 10.65±0.18 X103, 9.85±0.20 X103 per mm3, PCV were 29.70±0.70, 33.41±0.54, 28.46±0.71% and heamoglobin concentration were 10.25±0.23, 11.47±0.15 and 09.77±0.19 mg/dl, respectively during onset of estrus, standing heat and non-estrus stages of experimental sahiwal cows. Thus, the mean value for total erythrocyte count,total leucocyte count, PCV and blood hemoglobin concentration of these experimental cows were found to be significantly (P<0.05) higher during their standing heat stage as compared to onset of estrus as well as non-estrus stages.

Table 1: Mean ± SE values for haematological attributes of experimental sahiwal cows during their different stages of estrus.

Stages of estrus	RBC (X106/mm3)		WBC (X103/mm3)		PCV (%)		Hb (mg/dl)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Onset of estrus	6.62ab	0.11	10.14ab	0.21	29.70b	0.70	10.25b	0.23
Standing heat	6.79a	0.10	10.65a	0.18	33.41a	0.54	11.47a	0.15
Non-estrus	6.46b	0.10	9.85b	0.20	28.46b	0.71	9.77b	0.19
Overall pool mean	6.62	0.06	10.21	0.13	30.52	0.53	10.50	0.17

Values with different superscripts in the same column differ significantly (P<0.05) from each other The mean RBC and WBC counts during standing heat condition of estrus in experimental sahiwal cows under present study was found to be significantly higher than during their non estrus condition but no significant difference for these attributes could be observed between onset of estrus and standing heat as well as onset of estrus and non-estrus conditions. Similarly, Perumal et al. (2014) also reported that the total RBC count was non significantly (P≥0.05) higher in estrus cows than other stage of reproduction. This increase in total RBC count in estrus cows may be due to hyperactivity and excitement, which may be due to release of high level of estrogen (anabolic effects) from graffian follicles (Coles, 1986; Perumal et al., 2013). The leukocytosis during estrus may be attributed to adrenaline mediated mobilizationof the marginal neutrophil pool cells through leukocytosis inducing factor (Sastry, 1989). The mean PCV and Hb concentration during standing heat condition of estrus in experimental Sahiwal cows under present study was found to be significantly higher than during their onset of estrus as well as non estrus conditions but the

difference between onset of estrus and non-estrus conditions was found to be non-significant(P≥0.05). The present observations may be supported by the finding of Pathan et al. (2011) that the levels of haemoglobin and PCV were significantly higher in cyclic cows than those in non-cyclic cows. The higher levels of Hb and PCV are attributed to increase in RBC count in cyclic animals because of hyperactivity and excitement under the influence of estrogen (Ahmed et al., 2003).

Conclusion

The in efficient and inaccurate knowledge about the estrus, non-estrus and standing heat among the farmers leads to poor heat detection, failure of conception, increasing service and calving interval of animals, results in huge economical losses to our dairy farmers in India. Hence, on the basis of present experiment it can be concluded that hematological attributes (RBC count, WBC count, blood hemoglobin and PCV) may be used for precise identification of onset of estrus,standing heatand non estrus stages in Sahiwalcows. So, to improve the reproductive efficiency of dairy animals in terms of reducing service period,

conception rate and calving interval the estimation of hematological parameters can be used as a biomarkers for the onset of estrus, standing heat and non-estrus stages in Sahiwal cows to improve the productive, reproductive performances of cows as well as to improve the socio-economic condition of the farmers.

Acknowledgement

Conflict of interests: The authors have declared no conflict of interest exist.

References

1. Ahmad, I., Gohar, A., Ahmad, N. and Ahmad, M. (2003). Haematological profile in cyclic, non cyclic and endometritic cross-bred cattle. Int. J. Agri. Biol. 5(3): 332-334.

2. Coles, E. H. (1986). Veterinary clinical Pathology 4th ED., WB Saunders company Philadelphia. London, Toronto, Mexico, Riodejenario, Sydney, Tokyo and Hong Kong.

3. Heersche, G. and Nebel, R. L. (1994). Measuring efficiency and accuracy of detection of oestrus. J. Dairy Sci.77(9): 2754–2761.

4. Karir, T., Nagvekar, U. H., Samuel, G., Sivaprasad, P., Chaudhuri, P. and Samad, A. (2006). Estimation of progesterone in buffalo milk by radioimmunoassay. J. of Radioanalytical and Nuclear Chemistry. 267 (2): 321- 325.

5. Lobago, F., Bekana, M., Gustafsson, H. and Kindahl, H. (2007). Longitudinal observation on reproductive and lactation performances of smallholder crossbred dairy cattle in Fitche, Oromia region, central Ethiopia. Trop. Ani. Heal. Prod.39(6): 395-

403.

6. Pathan, M. M., Das, H., Khan,Md. J. Z., Siddiquee, G. M,., Latif, A. and Parsani, H.R. (2011). Comparative studies on haemato-biochemical profile of cyclic and non-cyclic Holstein-friesian cross-bred cow. Wayamba J. of Ani. Sci. 3:69-70.

7. Perumal, P., Das, S., Mohanty, D. N., Barik, A. K. and Mishra, P. C. (2013). Study of certain haemotological parameter in repeat breeding cows. Int. J. Bio-resource and Stress Management. 4(2): 242-245.

8. Perumal, P., Vupru, K., Khate, K., Veeraselvam, M., Verma, A. K., Nahak, A. K. and Rajkhowa, C. (2014). Blood profiles of mithun (Bosfrontalis) under different stages of reproduction. Int. J. Bio-resource and Stress Management. 5(1): 064-067.

9. Saint-Dizier, M. and Chastant-Maillard, S. (2012). Towards an automated detection of oestrus in dairy cattle. Reprod. in Dom. Ani.47(6):1056-1061.

10. Sastry, G. A. (1989). Veterinary Clinical Pathology. 3rd Ed., CBS. Publishers and Distributors (Pvt.) Ltd. Dehli, India.

11. Schams, D., Schallenberger, E., Hoffmann, B. and Karg, H. (1977). The oestrous cycle of the cow: Hormonal parameters and time relationships concerning oestrus, ovulation, and electrical resistance of the vaginal mucus. Acta Endocrinol. 86(1): 180–192.

12. Singh, D. N., Sirohi, R., Singh, Y., Kumar Ajay and P. K.Shukla (2018). Role of animal by-products utilization in doubling the farmers income. Indian Journal of Agricultural Business. 4 (1): 23-27.

13. Van Eerdenburg, F. J. C. M., Karthaus, D., Taverne, M. A. M., Merics, I. and Szenic, O. (2002).The relationship between estrous behavioural score and time of ovulation in dairy cattle. J. of Dairy Sci. 85(5): 1150-1156.

14. Ziegler, T. E., Epple, G., Snowdon, C. T., Porter, T. A., Belcher, A.M. and Kuderling, I. (1993). Detection of the chemical signals of ovulation in the cotton-toptamarin. Saguinusoedipus. Ani. Behav. 45: 313–322.