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Influence of Lactation Stages on Hematological Parameters of Indigenous Badri Cattle of Uttarakhand

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ABSTRACT

Badri is the first registered indigenous cattle breed of Uttarakhand, mainly reared in hilly areas of the state. The aim of the study was to evaluate the influence of lactation stages on hematological parameters. The study was carried out in forty healthy lactating cows divided into five groups with eight animals in each group during different stages of lactation viz. 0 to 60 days, 61 to 120 days, 121 to 180 days, 181 to 240 days and non-lactating animals. Hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), erythrocyte sedimentation rate (ESR), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), differential leucocyte count (DLC), absolute leucocyte count (ALC) and neutrophil: lymphocyte (N:L) were estimated. A significant effect of different stages of lactation on PCV, TEC, ESR, MCV, MCH, lymphocytes and neutrophils ($p<0.05$) was observed.

HIGHLIGHTS

- Lactation stages affect hemo-cellular dynamics.
- Lactation stages has effect on PCV, TEC, ESR, MCV, MCH, lymphocytes and neutrophils.

Keywords: Badri, indigenous, hematology, lactation, Uttarakhand

India has diversified animal genetic resources with 50 well recognized cattle breeds (DAHD, 2019). The conservation of indigenous livestock has been now foreseen in Indian scenario because of being a low input and low output production system that can provide sustainability, food security, protein nutrition and even the empowerment to the rural families. The existing indigenous cattle breeds have evolved over the centuries through natural selection for adaptation to harsh climatic conditions, resistance to common diseases and ability to thrive under extreme nutritional stress. The indigenous cattle of Uttarakhand was first certified on 21st June 2016 and named as Badri (Accession number INDIA_CATTLE_2400_BADRI_03040) (ICAR-NBAGR, 2016). It is mainly reared in hilly areas of the Kumaon and Garhwal regions of the state. Badri is a small sized breed having 200-250 kg body weight, with bright and alert eyes, erected ears, small wide neck and a prominent hump. The coat colour is varied as black, brown, red, white or grey, and hooves and muzzle are black or brown in colour. The legs are long and straight with hard foot pads for hilly and rugged terrains. Udder is small sized and tucked up within the body and milk yield is 1.5 (0.5-2.0) kg per day. The average age at first calving is 3-5 years and 8-10 times calving in its fertility life, lactation length is 208 days (6-8

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months) and long dry period of 138 days (4-6 months) (Pundir *et al*., 2012). Badri is well adapted to the hills under the prevailing climatic conditions and resistant to many diseases (Pundir *et al*., 2014) and have the potential to develop Uttarakhand as organic farming state (Banga *et al*., 2005). The livestock owners of Uttarakhand prefer Badri cattle over other animals due to salient importance in terms of religious value and others like better adaptability in hilly region, disease resistant, medicinal properties of milk and urine, good manure, requires less external inputs and more livelihood generation, docile temperament, quality milk flavour, excellent feed conversion efficiency and draught power (Joshi *et al.,* 2018).

Blood indices are becoming increasingly important in veterinary medicine as indicators of physiological, nutritional, metabolic and clinical status of farm animals (Mirzadeh *et al.*, 2010). There are several factors including age, sex, breed, seasonal variation, pregnancy, lactation, health and nutrition status that can affect the cellular hemodynamic (Devi and Kumar, 2012). Haematological parameters reflect the adaptability of the animals to adverse environmental conditions and other stressors (Koubkova *et al.,* 2002). Parturition and onset of lactation bring dairy cows into a state of increased metabolic activity. Maternal tissue starts the process of adaptation, particularly the mammary gland, such that nutritive matters are directed towards this gland (Blum *et al.,* 1983). Stage of lactation (Yaylak *et al.*, 2009) and nutrition affect the concentration of blood constituents of cattle (Rowlands *et al*., 1975). Therefore, the present study was undertaken to study the effect of different stages of lactation on hematological parameters.

MATERIALS AND METHODS

A total of forty healthy adult dairy Badri cows were selected from Instructional dairy farm (IDF) of GBPAUT, Pantnagar, Uttarakhand. It is located in the foothills of Himalayas at 29.5°N latitude and 79.3°E longitudes. The study was conducted at Department of Veterinary Physiology and Biochemistry, College of Veterinary and Animal Sciences. Animals were divided into five groups according to lactation stage with eight animals in each group. Group I (0-60 days), group II (>60-120 days), group III (>120-180 days), group IV (>180-240 days) and group V (non-lactating animals). The experimental animals were maintained and fed as per the standard practice followed at the farm. Blood samples from each animal were taken from jugular vein in EDTA-coated vacutainer tubes after taking all necessary aseptic and ethical measures. Hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), erythrocyte sedimentation rate (ESR), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), differential leucocyte count (DLC), absolute leucocyte count (ALC) and neutrophil: lymphocyte (N: L) were calculated as per standard methods. All the data were analysed statistically using SPSS software version 26.0 to determine analysis of variance between groups. Variable were analysed by Duncan's multiple range test with $p<0.05$ level of significance.

RESULTS AND DISCUSSION

The Mean ±SE values of Hb, PCV, ESR, TEC, TLC, MCH, MCHC, MCV, DLC, ALC and N: L are presented in table 1. Hb concentration was lower in group I and II, then, increased as lactation progressed and in non-lactating animals, though the difference was non-significant ($p>0.05$). PCV was significantly ($p>0.05$) higher in group IV as compared to group I. TEC was significantly higher in group II and IV and lower in group III as compared to non-lactating animals. TLC values were higher during all lactation stages than non-lactating animals but the difference was non-significant. ESR was significantly higher in group I and lower in group II than non-lactating animals. MCV and MCH were significantly higher in group III and lower in group II than non-lactating animals. MCHC was lower in group II and IV and higher during group I, III and V, but the variation was non-significant. Lymphocyte percent was significantly higher in group I and lower in non-lactating animals, whereas neutrophil percent was significantly lower in group I and higher in non-lactating animals. Monocytes, eosinophils and basophils percent showed non-significant ($p>0.05$) influence of lactation stages. N:L was lowest in group I and highest in non-lactating animals, though the difference was non-significant. Absolute lymphocyte count was significantly higher in group IV and lower in non-lactating animals. Absolute neutrophil count was significantly lower in group I and higher in group III. Non-significant influence

Table 1: Mean ±SE values of haematological entities during different stages of lactation in indigenous Badri cattle (n=8 in each group)

Hematological Entities	Stages of Lactation				
	Group I (0-60 days)	**Group II (61-120 days)**	**Group III (121-180 days)**	**Group IV (181-240 days)**	**Group V (non-lactating animals)**
Hb (g/dl)	8.57 ±0.63	8.33 ±0.39	9.27 ±0.42	9.37 ±0.56	9.72 ±0.68
PCV (%)	31.00 ±1.29^{a}	34.50 ±1.43^{ab}	33.37 ±1.08^{ab}	38.62 ±1.66^{b}	36.0 ±1.79^{ab}
TEC (10^6 /µl)	13.35 ±0.96^{ab}	15.67 ±0.47^{b}	10.43 ±1.35^{a}	14.62 ±1.13^{b}	13.48 ±0.92^{ab}
TLC (10^3 /µl)	7.44 ±0.63	7.95 ±0.99	7.84 ±1.06	7.95 ±1.06	6.31 ±0.63
ESR (mm/h)	13.13 ±1.32^{b}	7.113 ±1.26^{a}	9.87 ±0.85^{ab}	7.87 ±0.87^{a}	8.12 ±1.38^{a}
MCV (fl)	24.04 ±1.83^{a}	22.20 ±1.21^{a}	35.67 ±3.79^{b}	27.51 ±2.53^{ab}	27.61 ±2.26^{ab}
MCH (pg)	6.70 ±0.77^{ab}	5.36 ±0.35^{a}	9.97 ±1.32^{b}	6.82 ±0.89^{ab}	7.61 ±0.97^{ab}
MCHC (%)	27.47 ±1.40	24.32 ±1.29	27.82 ±0.94	24.39 ±1.31	27.11 ±1.67
Lym (%)	63.0 ±4.56^{b}	55.12 ±3.96^{ab}	50.25 ±4.71^{ab}	56.75 ±4.33^{ab}	43.75 ±1.96^{a}
Neut (%)	31.25 ±4.67^{a}	42.0 ±3.72^{ab}	46.0 ±5.42^{b}	39.87 ±4.33^{a}	51.75 ±1.81^{c}
Mon (%)	1.0 ±0.33	1.0 ±0.27	0.62 ±0.26	0.75 ±0.31	0.87 ±0.51
Eos (%)	3.75 ±0.59	3.0 ±0.53	3.0 ±0.71	2.50 ±0.42	3.5 ±0.60
Bas (%)	0.25 ±0.16	0.12 ±0.12	0.12 ±0.12	0.12 ±0.12	0.12 ±0.12
N:L	0.55 ±0.11	0.83 ±0.12	1.06 ±0.20	0.81 ±0.19	1.21 ±0.10
ALC					
Lym (10^3 /µl)	4.68 ±0.44^{ab}	4.04 ±0.62^{ab}	3.64 ±0.022^{ab}	4.74 ±0.84 ^{b}	2.76 ±0.29 ^{a}
Neut (10^3 /µl)	2.35 ±0.39 ^{a}	3.32 ±0.41^{ab}	3.96 ±0.86 ^{b}	2.95 ±0.23^{ab}	3.26 ±0.31^{ab}
Mon (10^3 /µl)	0.07 ±0.02	0.08 ±0.02	0.03 ±0.01	0.06 ±0.02	0.05 ±0.03
Eos (10^3 /µl)	0.28 ±0.05	0.23 ±0.04	0.33 ±0.07	0.20 ±0.04	0.22 ±0.04
Bas(10^3 /µl)	0.02 ±0.01	0.01 ±0.01	0.01 ±0.01	0.01 ±0.01	0.01 ±0.01

* Alphabetical letters (a, b and c) indicate significant *($p<0.05$)* difference between groups.

of lactation stages on ALC of monocytes, eosinophils and basophils was observed.

The Hb concentration was lower in early part of lactation which increased in later lactation stages. Similarly, Marcos (1982) and El-Nouty *et al.* (1986) reported higher Hb values in dry cows than lactating, whereas, Steinhardt *et al*. (1994) reported a decline in Hb with advancing lactation. Low Hb concentration during early lactation could be due to low protein status (Manston *et al.*, 1975) and non-significant rise in Hb concentration during lactation might be due to loss of plasma volume for increasing milk production and may also be attributed to hemoconcentration. Hb concentration fell with increased milk yield, but stage of lactation largely accounts for Hb concentration variation (Hewet *et al.*, 1975). PCV findings corroborates with the findings of Rajcevic *et al.* (1995) who reported lowest PCV values during early lactation. Previous studies reported consistently higher PCV values in non-lactating than lactating cows (Rowlands *et al.*, 1975), whereas Ghergaraiu *et al.* (1984) observed that PCV values were similar in lactating and non-lactating cows. Lower PCV values in early lactation could be associated with diet low in crude protein content (Pelletur *et al.*, 1985).

Our results corroborates with previous findings (Esievo and Moore, 1979) which reported decreased TEC values during early lactation, reached lowest during second month of lactation and then increased to pre-lactating levels by mid-lactation. Petrera and Abeni (2018) observed higher erythrocytes during lactation in cow, whereas El-Nouty *et al.* (1986) reported lower TEC count in lactating cows than dry cows which was contrary to present findings. The variation of TEC values may depend upon the stages of lactation for milk synthesis, since more blood is drained to mammary gland carrying all the essential nutrients and precursors through partitioning of nutrients during milk synthesis. Mean TEC was on higher side, which might be due to increased number and small size of erythrocytes.

Higher PCV values may be due to increased number of erythrocytes (Chineke, 2006). Lower values of PCV and TEC during early lactation stage might be due to increased plasma volume during gestation which takes few days after to restore normal values. Lower TLC during early lactation than other lactation stages which could be due to migration of leucocytes to uterus and mammary gland to fight against metritis and mastitis, respectively. A higher TLC values in late stage could be due to transition of animal body from lactation to drying off period (Deshpande *et al.,* 1987). Similarly, Petrera and Abeni (2018) reported decreased TLC after calving. ESR is positively influenced by rouleaux formation and plasma content of fibrinogen, α_2-globulins and γ-globulins and negatively influenced by plasma level of albumin. ESR is generally increased during pregnancy which might be due to physiological hemodilution as well as decreased erythrocyte numbers. Further, increased levels of globulins during end gestation and early lactation to provide innate immunity to young one and to enhance immune response of the mother to fight against peripartum diseases, plasma globulins levels rise, leading to higher ESR values during early lactation stage. All these factors would have led to increased levels of ESR during early lactation. Petrera and Abeni (2018) suggested a significant decrease ($p<0.05$) in MCV during lactation stages. El-Nouty *et al.* (1986) observed lower mean MCV values in lactating animals than dry cows. Petrera and Abeni (2018) found lowest level of neutrophils at first week after calving and then, neutrophil count increased significantly ($p<0.01$) as lactation progressed. This might be due to an impaired immune function during the peripartum period due to physiological stress induced by pregnancy, calving and onset of lactation. Detilleux *et al.* (1995) reported decline in neutrophils in one week after calving and then, it gradually increased to basal level, which could be due to extensive influx of neutrophils to the uterus and mammary gland during early lactation. Anderson *et al.* (1999) reported that normally there was increased number of circulating neutrophils during calving in response to high plasma concentration of glucocorticoids and lactogenic hormones while decreased with the onset of lactation. Thus, the function of leucocytes plays a vital role as the first line of defence in mammary gland against infections such as mastitis and in uterus against other peripartum infectious diseases.

CONCLUSION

The importance of the indigenous gene pool of different livestock species has been realized across the globe. It denotes the significance of reference values on hematological parameters as these are useful in determining the general health status of the animals. It may be concluded that different stages of lactation influenced the hematological parameters of indigenous Badri cattle. The data generated during the current investigation may be useful as reference values for this breed of cattle.

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