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Plasma iron, Hemoglobin and Packed Cell Volume during Puerperal Period in Beetal Goats

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ABSTRACT

The present research work was undertaken to study the puerperal hematological changes in Beetal at different stages of parity in Jammu region, J&K. Thirty six adult Beetal goats were categorized into 3 parity groups viz. group-A (1-3 parity), group-B (4-6 parity) and group-C (7-8 parity). Blood samples were collected 3 and 1 week before and 1, 2, 4, 8 and 16 weeks after kidding. The hemoglobin, PCV and plasma iron was analyzed from the collected blood samples. Analysis of haematological parameters viz. Hb and PCV revealed significant decline during the 1 week before and 1 ($p<0.001$) and 4 ($p<0.005$) weeks after kidding compared with 16 weeks after kidding. Prevalence rate of anaemia in goats having Hb level <8 g/dl and PCV level <22 per cent was highest 1 week after followed by 1 week before and 4 weeks after kidding. Low plasma iron levels were observed during peri-partum period. No significant difference in levels of Hb and PCV among various parity groups was observed. Physiological conditions- late pregnancy and early lactation are accompanied with marked decrease in Hb and PCV levels.

Keywords: Beetal goats, haematological parameters, prevalence, iron, parity, anaemia

Goat is one of the earliest food producing animals domesticated by the man and being a small sized ruminant is capable of integrating itself into socio economic up-liftment of society. Due to multifarious utility goats has been also labelled as 'poor man's cow'. The total goat population of India increased from 47 million in 1951 to 135 million in 2012, registering an average annual compound growth rate of 2.0%. J&K State has 0.014% of the country's goat population.

The Jammu division of state supports two third of state's goat population and rest lies with in Kashmir division. Goat plays a vital role in Kandi belt of Jammu. Despite the social and economic values, the research activities on goats in our country are neglected. Pregnancy and lactation are considered as a metabolic stress. The livestock production system is sensitive to climate change and at the same time itself a contributor to the phenomenon, climate change has the potential to be an increasingly formidable challenge to the development of the livestock sector (Chauhan and Ghosh 2014). Crossbred animals can readily adapt to a thermal exposure and may acclimatize with sustainable biochemical and physiological changes but fail to do so at the thermal exposure of 40°C (Yadav *et al.* 2015).

Hematological values are widely used to determine systematic relationship and physiological adaptation including the assessment of general health condition of animal and animal with animals with good blood composition are likely to show good performance (Isaac *et al.* 2013). The examination of blood gives the opportunity to investigate the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutrition and pathological status of an organism (Olafedehan *et al.* 2010). In goats, the transition period has gained little attention. Most of the available data describing metabolism during the transition phase is based on only a few measurements (Skotnicka *et al.* 2011). More frequent sampling and measurement of blood metabolites should be used to capture the dynamic changes in the peri-parturient period (Tharwat *et al.* 2015). The present study was therefore designed to gain detailed information on plasma iron, haemoglobin and hematocrit in goat and effect of parity on them, if any.

MATERIALS AND METHODS

The study was conducted at an organised Government Dairy Goat Farm, Rajbagh, Kathua. 36 Beetal goats from Dairy Goat Farm reared under semi-intensive system were selected. Comprehensive history of the selected animals including pregnancy status, previous disease condition, feeding status along with managemental practices followed was recorded. Selected animals were categorized into three parity groups viz. group-A (1-3 parity), group-B (4-6 parity) and group-C (7-8 parity). All goats were dewormed before start of trial using fenbendazole @ 7.5mg/kg b. wt. thereafter repeated at an interval of 3 months.Blood samples were collected from each goat, 3 and 1week before and 1, 2, 4, 8 and 16 weeks after kidding. For determining haemoglobin (Hb) and packed cell volume (PCV), 2 ml of blood sample was collected from each selected animal in sterile plastic tubes containing dipotassium salt of EDTA as anticoagulant (Hi Media Mumbai, @ 2 mg/ml of blood). Haemoglobin was measured by Drabkins' method and packed cell volume by micro-Hematocrit method. For the estimation of plasma iron (Fe), ten ml of blood was collected by jugular venipuncture into a 30 ml stoppered mineral free heparinised glass vials (dipped overnight in 2N HCl). The blood was centrifuged and plasma collected. Plasma sample (2 ml) was analysed for Fe estimation by digesting in distilled concentrated nitric acid AR (15 ml) and perchloric acid, Merck (3 ml) followed by one cycle of hydrogen peroxide AR (2.0 ml of 30%). Digestates (approximately 1 ml) were diluted to 10 ml with double glass distilled water. The concentrations of Fe were measured by Polarized Zeeman Atomic Absorption Spectrophotometer (Z-2300, HITACHI).

Statistical analysis

Standard statistical procedures were followed and the data collected during the experiment was subjected to analysis of variance which was carried in completely randomized design (CRD) and the significance was tested using Tukey Multiple Range Test. The significance was assayed at 5 percent ($P < 0.05$) levels.

RESULTS

The average value of Hb and PCV varied from 8.01 ± 0.60 to 11.09 ± 0.29 g/dl and 25.62 ± 1.11 to 35.48 ± 0.53% respectively. Significant decrease in Hb and PCV level was observed 1 ($p = 0.037$) week before and 1 ($p<0.001$) and 4 ($p = 0.009$) weeks after kidding compared with levels observed 16 weeks after kidding. The lowest values of Hb and PCV was observed among group-B animals followed by group-A and group-C animals. Prevalence rate of anaemia in goats having Hb level < 8 g/dl and PCV level < 22% was highest 1 week after followed by 1 week before and 4 weeks after kidding (Fig. 1, Fig. 2). A significant decrease in the level of iron was observed 2 ($p=0.010$) weeks after kidding compared with values observed 16 weeks after kidding however non-significant decline in plasma Fe status was observed 1, 4 and 8 weeks after kidding (Table 1). Similar trend was observed among various parity groups. No significant difference in levels of Hb, PCV or iron was observed among various parity groups.

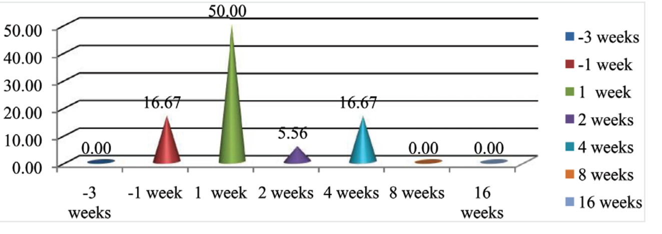

Fig. 1: Depicting prevalence rate of anaemia based on Hb level among Beetal goats during pregnancy and lactation

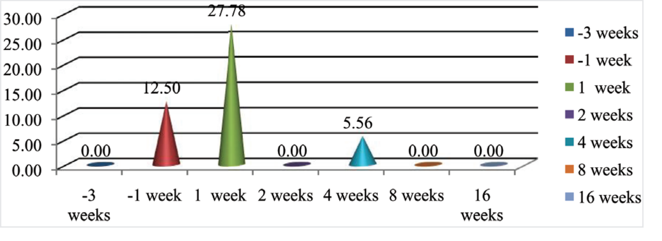

Fig. 2: Depicting prevalence rate of anaemia based on PCV level among Beetal goats during pregnancy and lactation

DISCUSSION

The average values of Hb and PCV varied from 8.01 ± 0.60 to 11.09 ± 0.29 g/dl and 25.62 ± 1.11 to 35.48 ± 0.53 per cent which were within normal range of 8-12 g/dl and 22-38 which are within the normal range for goats (Weiss

Table 1: Haemoglobin (g/dl), PCV (%) and Plasma iron (µmol/l)status of Beetal goats during pregnancy and lactation

(Mean±S.E)

Weeks		**Before Kidding**		**After Kidding**					**Total**
Parity Groups **3 Weeks**		**1 Week**	**1 Week**	**2 Weeks**	**4 Weeks**	**8 Weeks**		**16 Weeks**	
Hb	Group-A	9.98 ± 0.29^{aA}	9.99 ± 1.19^{aA}	8.57 ± 0.67^{aA}	9.56 ± 0.46^{aA}	9.31 ± 0.55^{aA}	11.05 ± 0.29^{aA}	11.08 ± 0.31^{aA}	9.93 ± 0.24
	Group-B	11.41 ± 0.51^{aA}	9.25 ± 0.42^{abA}	8.25 ± 0.50^{bA}	10.00 ± 0.62^{abA}	9.06 ± 0.44^{abA}	10.27 ± 0.22^{abA}	10.44 ± 0.16^{abA}	9.81 ± 0.20
	Group-C	11.53 ± 0.34^{bA}	10.19 ± 0.73^{bA}	7.20 ± 0.60^{aA}	10.33 ± 0.43^{bA}	10.48 ± 0.27^{bA}	9.73 ± 0.33^{abA}	11.75 ± 0.23^{bA}	10.17 ± 0.23
	Total	10.97 ± 0.25^{ac}	9.81 ± 0.47^{ab}	8.01 ± 0.35^{d}	9.96 ± 0.29^{abc}	9.62 ± 0.27^{b}	10.35 ± 0.19^{abc}	11.09 ± 0.17^{c}	
PCV	Group-A	31.92 ± 0.92^{aA}	31.96 ± 3.81^{aA}	27.43 ± 2.16^{aA}	30.58 ± 1.46^{aA}	29.81 ± 1.75^{aA}	35.35 ± 0.94^{aA}	35.45 ± 0.98^{aA}	31.79 ± 0.78
	Group-B	36.50 ± 1.62^{aA}	29.60 ± 1.36^{abA}	26.40 ± 1.61^{bA}	32.01 ± 1.99^{abA}	29.01 ± 1.42^{abA}	32.88 ± 0.70^{abA}	33.39 ± 0.50^{abA}	31.40 ± 0.63
	Group-C	36.91 ± 1.09^{bA}	32.61 ± 2.34^{bA}	23.04 ± 1.91^{aA}	33.07 ± 1.38^{bA}	33.54 ± 0.85^{bA}	31.13 ± 1.06^{abA}	37.59 ± 0.75^{bA}	32.56 ± 0.75
	Total	35.11 ± 0.81^{ac}	31.39 ± 1.52^{ab}	25.62 ± 1.11^{d}	31.89 ± 0.93^{abc}	30.78 ± 0.86^{b}	33.12 ± 0.60^{abc}	35.48 ± 0.53^{c}	
Fe	Group-A	247.16 ± 16.37^{bB}	105.85 ± 5.83^{aA}	84.35 ± 5.20^{aA}	78.46 ± 5.67^{aA}	102.29 ± 7.54^{aA}	94.55 ± 4.07^{aA}	101.86 ± 2.61^{aA}	116.36 ± 7.12
	Group-B	180.16 ± 9.91^{aA}	143.11 ± 8.02^{abA}	108.54 ± 7.44^{bcA}	75.92 ± 5.41^{cA}	77.24 ± 5.86^{cA}	84.55 ± 3.82^{cA}	110.50 ± 3.72^{bcA}	111.43 ± 4.91
	Group-C	175.08 ± 11.69^{cA}	121.11 ± 5.78^{aA}	99.95 ± 6.92^{abA}	76.29 ± 6.60^{bA}	87.12 ± 14.27^{abA}	101.68 ± 8.59^{abA}	86.14 ± 4.98^{abA}	106.77 ± 4.93
	Total	200.80 ± 9.44^{c}	123.36 ± 4.65^{d}	97.61 ± 4.11^{b}	76.89 ± 3.30^{a}	88.88 ± 5.84^{ab}	93.59 ± 3.54^{ab}	99.50 ± 2.87^{b}	

Figures with different small letter superscripts in a row differ significantly ($p<0.05$)

Figures with different capital letter superscripts in a column differ significantly ($p<0.05$)

and Wardrop 2010). Significant decrease in Hb and PCV level was observed during end of gestation period and continued till early lactation. These findings corroborate with reports of Tharwat *et al.* (2015) who also reported a significant decrease in Hb and PCV levels during the transition period in goats. In goats, blood volume expands in parallel with increases in body weight during pregnancy (Olsson *et al.* 2001). The reduction in PCV and Hb levels at the end of gestation, represents "Pregnant Physiological anemia" a clinical condition described in various species This pregnant physiological anaemia observed in late pregnancy of domestic animals may have a physiological importance as it reduces the blood viscosity, thereby greatly increasing the blood flow in the small blood vessels (Poljičak-Milas *et al,* 2009; Habibu *et al.* 2014).

This is aimed at satisfying the demand of the new vascular bed since some amount of blood must occupy spaces in the uterus and maternal placenta and also to compensate for the expected blood loss during delivery (Ramsay 2010). Lower pre-partum Hematocrit and Hb has been reported in goats (Habibu *et al.* 2014) and ewes (Mohammad *et al.* 2014). The transition period from gestation to lactation has been seen to cause major shift in metabolism leading to oxidative stress in domestic animal (Celi *et al.* 2008; Castillo *et al.* 2006) with increase in lipid peroxidation and decrease in antioxidant capacity (Castillo *et al.* 2006). Thus, RBCs being rich in the poly unsaturated fatty acids are very prone to the lipid peroxidation which might have caused observed decreased in Hb and PCV in the early lactation. These changes were also reported in cattle during the peri-parturient period and may have resulted from the stress associated with parturition and lactation (El-Ghoul *et al.* 2000). There are some reports of change in Hb and PCV according to parity in sheep (Anwer *et al.* 2012) however we observed no affect of parity on Hb and PCV.

Also Plasma Fe level was observed to decline during late pregnancy and continued to show declining trend for first 2 weeks postpartum which could be another cause of decreased Hb and PCV during this period. Fe present in maternal blood is mainly bound with proteins called transferrin and ferritin and the amount of ferritin has been found to decrease as gestation progresses. The recorded decline in serum Fe during late pregnancy could be related to the great demand for this element by the foetus (Gurdogan *et al.* 2006), because the iron concentration in the foetus liver increases continuously with the advance of pregnancy. Decrease in early lactation could be contributes to increased synthesis of milk and an increased need for Fe (Antunović *et al.* 2011)

CONCLUSION

Physiological conditions- late pregnancy and early lactation are accompanied with marked decrease in Hb, PCV and plasma iron levels which decrease oxygen carrying capacity of blood resulting in to reduction in O_2 supply to the foetus. Thus during this period animal should be well fed and supplemented with iron mixtures to prevent anaemia.

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