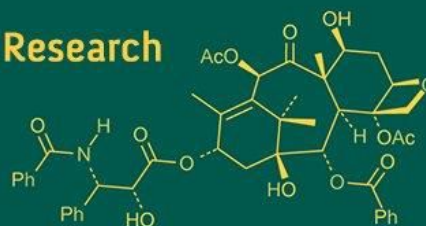


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Haematological variations during peripartum period in *Magra* sheep

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Abstract

An investigation was conducted to evaluate the alteration in haematological profile during the peripartum period in *Magra* sheep belonging to the Livestock Research Station, Kodamdesar, Bikaner. A total of 75 apparently healthy sheep above eight months of age were grouped according to their physiological status. In each group 15 sheep were selected and the non-pregnant sheep served as control. Blood samples were collected from each animal during non-pregnant, mid-pregnancy (80–120 days), late-pregnancy (120–140 days), on the day of lambing (within 12 hrs.) and one week after lambing. A significant ($p \leq 0.01$) decrease in the mean values of haemoglobin (Hb) and packed cell volume (PCV) were observed in *Magra* sheep with the advancement of pregnancy, after that the mean values increased significantly. The minimum value of haemoglobin (Hb) and packed cell volume (PCV) were observed orderly on the day of lambing (within 12 hours of lambing) and during late-pregnancy (120–140 days). Overall, the result of the present investigation showed the changes in haematological parameters which indicate that the animals were in the stage of oxidative stress with the advancement of pregnancy due to an increase in oxygen, nutrient demand and decrease in the mean values of haemoglobin (Hb) and packed cell volume (PCV) that partially managed by the haemodilution mechanism.

Keywords: Haematological profile, *Magra* sheep, peripartum period

Introduction

The value of blood parameters are influenced by several factors such as physiological status, stress, sex, breed, age, diet, handling, climate, and the laboratorial methodology (Kaneko *et al.*, 2008) ^[1]. According to Rens and Lende (2004) ^[2] parturition is the most important event of an animal's life. It is a complex process that involves changes at the hormonal, physiological, morphological, and behavioural levels. Metabolism of an animal's is influenced by the physiological states of pregnancy and lactation (Iriadam, 2007) ^[3]. Blood parameters are used for evaluating the individual's health conditions and monitoring the nutritional and metabolic conditions of the animals. During pregnancy period, increased metabolic activity and negative energy balance might also lead the sheep to a compromised state. During pregnancy there is drastic increase in energetic and oxygen demands to ensure an adequate foetal development and growth.

All of the parameters that were analyzed during this research are related to a group whose blood levels can be used as a diagnostic tool to evaluate the cellular function of animal during the stage of pregnancy. The research was carried out to assess the hematological parameters impacted by the peripartum period in *Magra* Sheep.

Materials and Methods**Experimental Material**

To achieve the objectives of the proposed plan, seventy-five apparently healthy *Magra* sheep above eight months of age belonging to the Livestock Research Station, Kodamdesar, Bikaner were examined. Fifteen non-pregnant sheep served as control and sixty sheep during peripartum were screened to observe the effect. To fulfill the aim of research, blood samples

were collected in clean and dried test tubes with K₂EDTA anticoagulant for haematological analysis.

Experimental Design

The experiment's goal was to determine the haematological indices in the blood samples of *Magra* Sheep during peripartum. The sampling was done as shown below in Table 1.

Methodologies of analysis used for evaluating the haematological indices

1. Haemoglobin (Hb)

1.1 Method employed: Sahli's hemoglobinometer method, as described by Schalm (1986) ^[4].

1.2 Procedure: Haemoglobin was converted to acid haematin by N/10 HCl. The acid separates the globin from the haemoglobin, resulting in the formation of acid haematin, which is a brown-coloured substance. The tube was kept for 10 minutes for formations of acid haematin then distilled water was added slowly until the colour matched the standard yellowish haemoglobinometer brown glass tubes fitted in the haemoglobinometer.

2. Packed cell volume (PCV)

2.1 Method employed: Standard technique described by Schalm (1986) ^[4].

2.2 Procedure: Wintrobe's tube was filled with anticoagulant-mixed blood up to mark 10 and centrifuged for 30 minutes at 3000 rpm. The recording of PCV (packed cell volume) was expressed in percent.

Statistical Analysis

The obtained data were analysed using the statistical package for the social sciences (SPSS, Version 26.0) software, and the comparison of mean values was done using one-way analysis of variance (ANOVA) techniques. Post Hoc Duncan's new multiple range test (Duncan, 1955) ^[5] was applied to explain the significance difference between the means of various physiological states. Per cent variations of each physiological state were also calculated with respect to the mean value of the respective non-pregnant animals (control). Pearson's correlation test was used to determine the relationship between the parameters.

Ethical Considerations

Proper care was taken to minimize stress and ensure animal welfare throughout the study. All the sampling were done as per standard protocol and permission from IAEC had been obtained (Approval no. CVAS/IAEC/2023-2024 Dated 19/07/2023).

Results and Discussion

Each parameter was assigned a control value based on fifteen non-pregnant animals. The mean values are obtained from sixty sheep, fifteen each in their mid-pregnancy, late-pregnancy, on the day of lambing (within 12 hours of lambing) and one week after lambing for each parameter. Significance has been exhibited in the form of superscripts on the mean values and is well illustrated as footnotes.

The obtained control value of Hb and PCV was to be 11.30

± 0.36 g/dl and 34.58 ± 0.45% respectively. This value was used to analyze the data collected from 60 *Magra* sheep during their peripartum period. It was observed during the study that a significant decrease in Hb and PCV mean values from mid-pregnancy to late-pregnancy, while there was start to significant increase in these values from on the day of lambing (within 12 hours of lambing) to one week after lambing. Analysis of variance revealed a highly significant ($p \leq 0.01$) effect of pregnancy and lambing on the mean values of haemoglobin and packed cell volume (PCV) during this study period. No significant difference was observed between the mean value of Hb during mid-pregnancy and late-pregnancy, but in PCV a significant difference was observed. On the day of lambing and one week after lambing, a significant effect was observed between the mean values of haemoglobin but a non-significant difference in PCV was observed. Overall the maximum per cent decline in Hb and PCV was observed during on the day of lambing and during late-pregnancy respectively.

The observations of haematological studies are presented according to different peripartum stages of female *Magra* sheep in Table 2, Analysis of variance of haemoglobin and packed cell volume (PCV) in Table 3 & 4 respectively. The data presented in Table 5 show a strong positive correlation between the Hb and PCV ($r = 0.549$), which is highly significant ($p \leq 0.01$), it indicates that if Hb decreases, then PCV will also decrease that is also investigated by Weatherall and Sherry, 1997 ^[6] ($PCV = Hb \times 2.941$).

The results are also shown in graphical form for Haemoglobin in Fig. 1 & 2 and for Packed Cell Volume in Fig. 3 & 4.

The results of this study show that Hb and PCV sharply decline with the advancement of pregnancy. As pregnancy progresses, physiological adaptation results in "Pregnancy-Associated Physiologic Anemia," which dilutes hemoglobin and red blood cells because plasma volume increases more than red blood cell volume, which paradoxically leads to lower hemoglobin levels to improve nutrient delivery to the growing foetus.

The results of the current study also consistent with the previous researchers, a decrease in mean values of haemoglobin (Hb) and packed cell volume (PCV) with the advancement of pregnancy was also observed by Iriadam (2007) ^[3] and Abdul-Rahaman *et al.* (2019) ^[7] in goats and Simsek *et al.* (2015) ^[8] in cats; however, Bamerny *et al.* (2022) ^[9] in goats, El-Sherif and Assad (2001) ^[10] observed increase in mean values of haemoglobin with the advancement of pregnancy in *Barki* ewes.

Contrary to present investigation, Azab *et al.* (1999) ^[11] observed that the maximum value haemoglobin was on the day of lambing and decreased after lambing in goats but similar effect was also observed by Anosa and Ogbogu (1979) ^[12] in sheep and Iriadam (2007) ^[3] in goats. They found PCV was increased on the day of lambing.

Hb and PCV were significantly decreased with the advancement of pregnancy. This decrease was in agreement with the results of previous research conducted on sheep and goats (Vihan and Rai, 1987) ^[13], and by Ate *et al.* (2009) ^[14] in cattle. Abraham *et al.* (2019) ^[15] in sheep also observed that the mean value of Hb was lower in pregnant animals than in non-pregnant animals.

Table 1: Protocol for blood sampling to see the effect of peripartum period on haematological parameters

Physiological states	Non Pregnant (Control)	Mid Pregnancy (80-120 days)	Late Pregnancy (120-140 days)	On the day of lambing (Within 12 hours of lambing)	One week after lambing
Total number of animals (n=75)	15	15	15	15	15

Control: non-pregnant animals

n: Total number of animals

Table 2: Changes in values (Mean $\pm$ SEM) of Haemoglobin (g/dl) and Packed Cell Volume (%) during different peripartum stages in female *Magra* sheep.

Peripartum stages	Haemoglobin (Hb)	Packed cell volume (PCV)
Non-pregnant (Control) (n= 15)	11.30 $\pm$ 0.36 ^c	34.58 $\pm$ 0.45 ^c
Mid-pregnancy (80-120 days) (n= 15)	10.52 $\pm$ 0.34 ^{bc}	33.40 $\pm$ 0.46 ^b
Late-pregnancy (120-140 days) (n= 15)	9.76 $\pm$ 0.22 ^{ab}	31.50 $\pm$ 0.22 ^a
On the day of lambing (Within 12 hours of lambing) (n= 15)	9.11 $\pm$ 0.19 ^a	32.69 $\pm$ 0.27 ^b
One week after lambing (n= 15)	11.19 $\pm$ 0.31 ^c	33.14 $\pm$ 0.22 ^b
Overall Mean (n= 75)	10.38 $\pm$ 0.16	33.06 $\pm$ 0.19

Values within the same column with different superscripts a-c differ significantly at $p \leq 0.01$ for haemoglobin and packed cell volume.

n: number of animals

Table 3: Analysis of variance of haemoglobin (Hb) of female *Magra* sheep during various peripartum stages

Source of Variation	Sum of Squares	Degree of Freedom	Mean Square	F-Value
Between Groups	52.807	4	13.202	10.011**
Within Groups	92.313	70	1.319	
Total	145.120	74		

Superscripts ** represents highly significant ($p \leq 0.01$) difference between the groups

Table 4: Analysis of variance of packed cell volume (PCV) of female *Magra* sheep during various peripartum stages

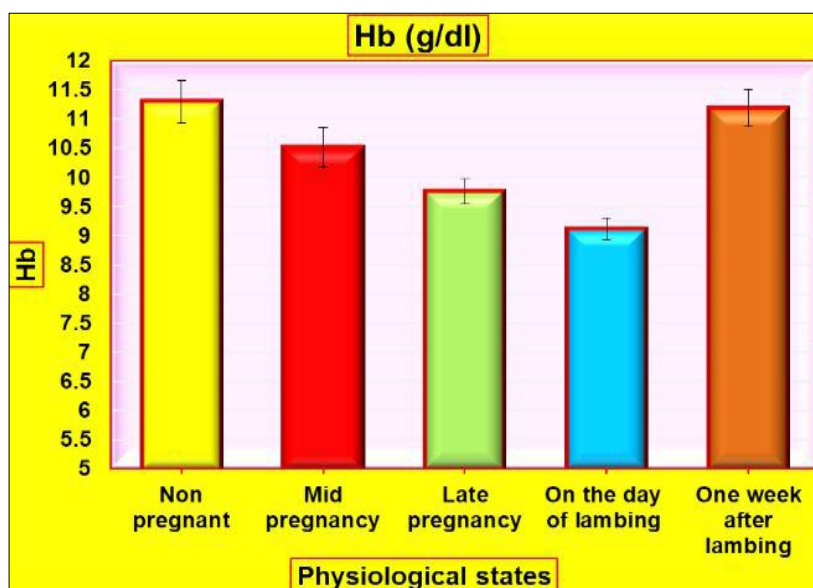
Source of Variation	Sum of Squares	Degree of Freedom	Mean Square	F-Value
Between Groups	75.022	4	18.756	10.444**
Within Groups	125.711	70	1.796	
Total	200.733	74		

Superscripts ** represents highly significant ($p \leq 0.01$) difference between the groups

Table 5: Correlation coefficients (r) between the haemoglobin (Hb) and packed cell volume (PCV) of female *Magra* sheep during various peripartum stages (n = 75)

	Haemoglobin (Hb)	Packed cell volume (PCV)
Haemoglobin (Hb)	1	0.549**
Packed cell volume (PCV)		1

Superscripts ** represents correlation is significant at the 0.01 level (2-tailed). between the Hb and PCV. is significant at the 0.01 level (2-tailed)

**Fig 1:** The mean $\pm$ SEM changes in haemoglobin of female *Magra* sheep during various physiological states

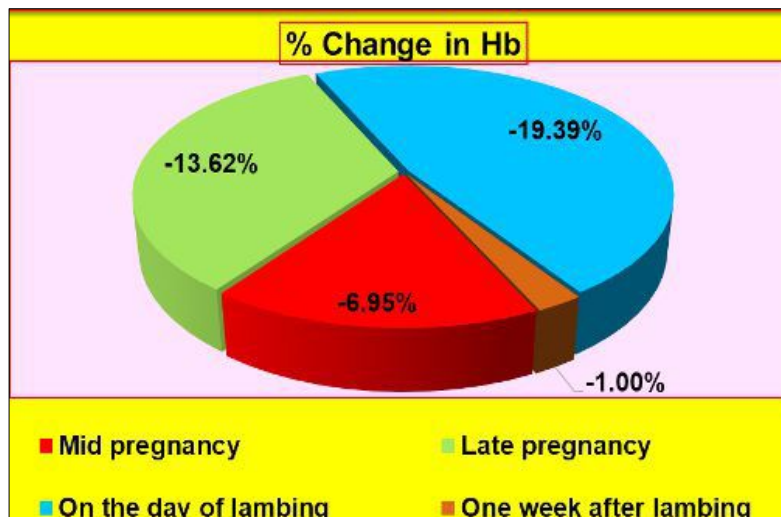


Fig 2: Per cent changes in haemoglobin of female *Magra* sheep during various physiological states with respect to control

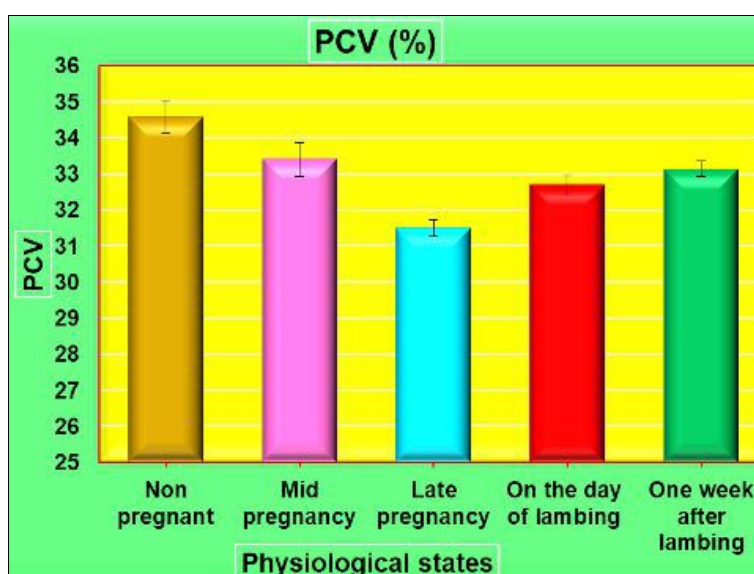


Fig 3: The mean $\pm$ SEM changes in packed cell volume of female *Magra* sheep during various physiological states

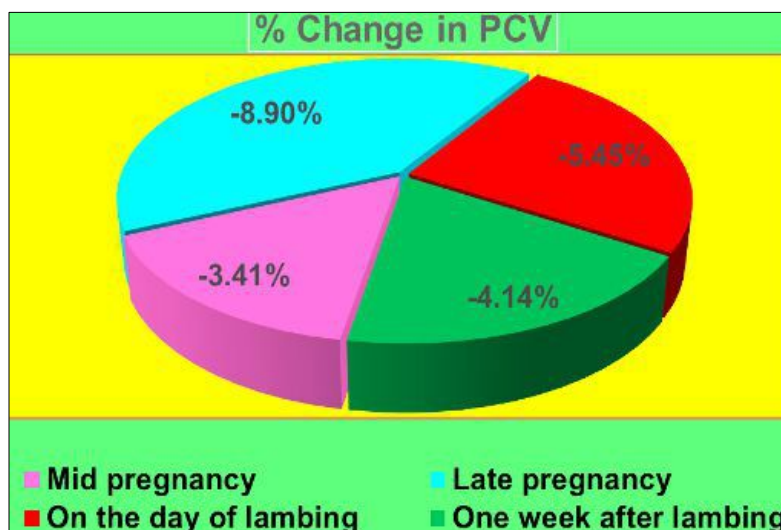


Fig 4: Per cent changes in serum packed cell volume of female *Magra* sheep during various physiological states with respect to control

Conclusion

Haematological parameters in female *Magra* sheep are significantly influenced by the different stages of peripartum, as there is a continuous increase in the demands of oxygen and nutrients with the advancement of pregnancy

for the growing foetus and modification in the metabolism of the animal that leads to a decrease in mean values of Hb and PCV. A rise in the mean Hb and PCV values one week after lambing indicates that the animal will physiologically relax following parturition as a result of the reduced stress

of pregnancy. The findings of the present study advance our knowledge of the physiology of the *Magra* sheep breed and will be helpful in the creation of disease diagnosis techniques in the field of veterinary clinical physiology.

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