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Short communication

Biochemical and Hormonal Changes Associated with Pregnancy in Barbary Ewes Under Semi-Arid Conditions in Eastern Libya

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Abstract
This study evaluated changes in hematological indices and selected hormonal parameters in Barbary ewes during pregnancy under semi-arid conditions in eastern Libya. Forty clinically healthy ewes were allocated to four groups (n = 10 each): non-pregnant controls and pregnant ewes at the 2nd, 4th, and 5th months of gestation. Blood samples were collected to measure red blood cell count (RBC), white blood cell count (WBC), hemoglobin concentration (Hb), packed cell volume (PCV), and serum insulin and parathormone (PTH). Data were analyzed by one-way ANOVA with Tukey's post hoc test at $p < 0.05$. Results: RBC, Hb, and PCV decreased progressively with advancing gestation, whereas WBC increased. Insulin declined significantly from the control group to late gestation, while PTH increased significantly during the same period. The most marked changes were observed in the 4th and 5th months of pregnancy. Conclusion: Pregnancy in Barbary ewes was associated with coordinated hematological and endocrine adjustments, especially in late gestation. These findings indicate altered oxygen-transport indices, enhanced leukocytic activity, modified energy metabolism, and increased calcium regulatory demand. Monitoring these parameters may support better health and nutritional management of pregnant ewes in semi-arid production systems.
Keywords. Barbary Ewe, Pregnancy, Hematology, Insulin, Parathormone, Semi-Arid Environment.

Introduction

Pregnancy in small ruminants is accompanied by physiological adaptations that support fetal growth while preserving maternal homeostasis. These adaptations affect blood composition, energy metabolism, immune function, and mineral regulation [1]. In sheep, reductions in erythrocytic indices during gestation are commonly linked to plasma volume expansion, whereas increases in leukocyte counts reflect immunological adjustment [2]. Endocrine regulators such as insulin and parathormone also change during pregnancy to support nutrient partitioning and calcium balance [3,4]. Environmental stress may intensify these responses in semi-arid production systems, where heat load, fluctuating forage quality, and limited water availability can increase metabolic demand. However, integrated data on hematological and hormonal responses during pregnancy remain limited for indigenous sheep breeds raised under field conditions. [4,5,6]. Therefore, this study aimed to evaluate changes in selected hematological and hormonal parameters in Barbary ewes at different stages of gestation in eastern Libya.

Methods

The study was conducted in the Al-Batnan region (Tobruk, eastern Libya), an area characterized by a semi-arid Mediterranean climate. A total of 40 clinically healthy Barbary ewes aged 2–4 years and of similar body condition were enrolled from local flocks managed under comparable extensive or semi-extensive systems. The animals were assigned to four groups (n = 10 per group) according to physiological status: non-pregnant controls, and pregnant ewes at the 2nd, 4th, and 5th months of gestation. The pregnancy stage was determined from reproductive records and standard pregnancy assessment methods. Blood was collected from the jugular vein in the morning before feeding. Samples in EDTA tubes were used for hematological analysis, and samples in plain tubes were centrifuged at 3000 rpm for 10–15 min to obtain serum for hormonal assays. The measured hematological parameters were RBC, WBC, Hb, and PCV. Serum insulin and PTH were measured using commercial ELISA kits according to the manufacturers' instructions. All hormonal assays were performed in duplicate [1,3,7]. Data were expressed as mean ± standard error (SE) and analyzed using one-way ANOVA followed by Tukey's test. Differences were considered significant at $p < 0.05$.

Results

The pregnancy stage significantly affected both hematological and hormonal variables. RBC, Hb, and PCV decreased progressively with advancing gestation, whereas WBC increased. The largest changes were recorded during the 4th and 5th months of pregnancy. Serum insulin declined significantly from 12.5 ± 0.5 µIU/mL in non-pregnant ewes to 8.9 ± 0.3 µIU/mL in the 5th month of gestation. In contrast, PTH increased from 35 ± 2 pg/mL in controls to 52 ± 3 pg/mL in late gestation.

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Table 1. Hematological parameters (mean ± SE) of Barbary ewes at different stages of pregnancy.

Parameter	Control	2nd month	4th month	5th month
RBC ($\times 10^6$/µL)	9.8 ± 0.3	9.2 ± 0.2	8.5 ± 0.3*	8.0 ± 0.2*
Hb (g/dL)	11.5 ± 0.4	10.8 ± 0.3	10.2 ± 0.2*	9.6 ± 0.3*
PCV (%)	34.2 ± 1.1	32.5 ± 1.0	30.8 ± 0.9*	29.4 ± 1.0*
WBC ($\times 10^3$/µL)	7.2 ± 0.3	7.8 ± 0.2	8.5 ± 0.3*	9.1 ± 0.4*

Note: indicates a significant difference compared with the control group ($p < 0.05$).

Table 2. Hormonal parameters (mean ± SE) of Barbary ewes at different stages of pregnancy.

Hormone	Control	2nd month	4th month	5th month
Insulin (µIU/mL)	12.5 ± 0.5	11.0 ± 0.4	9.8 ± 0.3*	8.9 ± 0.3*
PTH (pg/mL)	35 ± 2	40 ± 2	48 ± 3*	52 ± 3*

Note: indicates a significant difference compared with the control group ($p < 0.05$).

Discussion

The decline in RBC, Hb, and PCV is consistent with physiological hemodilution during pregnancy, in which plasma volume expansion exceeds the increase in erythrocyte mass [8]. This response may improve uteroplacental perfusion, although marked reductions may indicate increased physiological burden under limited nutritional conditions [9,10]. The rise in WBC suggests activation of maternal immune mechanisms required to maintain pregnancy while preserving host defense [11]. The reduction in insulin observed with advancing gestation is compatible with altered maternal glucose metabolism and a greater allocation of nutrients to the fetus. The increase in PTH indicates greater calcium regulatory demand during fetal skeletal development, especially in late gestation. Together, these findings support the view that hematological and endocrine systems act in a coordinated manner during pregnancy [12]. The overall pattern agrees with previous reports in sheep showing gestational declines in erythrocytic indices, increased leukocyte counts, altered insulin dynamics, and elevated calcium-regulating hormones [7,8]. In the present study, these adjustments may have been further influenced by semi-arid environmental conditions, which can intensify metabolic and endocrine stress [11,12].

Conclusion

Pregnancy in Barbary ewes was associated with significant reductions in RBC, Hb, PCV, and insulin, together with increases in WBC and PTH, particularly in late gestation. These changes indicate coordinated adaptation of hematological, metabolic, and mineral-regulatory systems. Routine monitoring of these indicators may help improve nutritional and clinical management of pregnant ewes under semi-arid conditions.

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