

## Monitoring of the Haematological Parameters in Camels (*Camelus dromedarius*) during Late Pregnancy and Early Lactation

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### Abstract

The objective of this study was to assess the effect of late pregnancy and early lactation on the haematological parameters in dromedary camels. Twenty time-mated multiparous females of Arabi breed (10 pregnant and 10 non-pregnant, age: 8-16 years, number of parities: 2 - 3) were used. Blood samples were collected once from non-pregnant camels and during late pregnancy and early lactation by jugular venipuncture into collection tubes containing EDTA. The blood samples were used for the determination of haematological parameters (total erythrocytes and total and differential leukocytes counts: TEC, TLC and DLC, haemoglobin: Hb, packed cell volume: PCV, mean corpuscular volume: MCV, mean corpuscular haemoglobin: MCH and mean corpuscular haemoglobin concentration: MCHC) using Automated Haematology analyser. ANOVA tests were used to assess the difference between the groups. The TEC decreased significantly ( $P < 0.05$ ) during late pregnancy compared to the control and early lactation, whereas [Hb] decreased significantly ( $P \leq 0.05$ ) during late pregnancy, early lactation compared to the control group. Late pregnancy and early lactation had no significant effect on PCV, MCV, MCH, MCHC, TLC and basophils percentage. Neutrophils percentage increased significantly ( $P < 0.01$ ) during the early lactation compared to the control and decreased ( $P < 0.05$ ) compared to late pregnancy. Significantly ( $P < 0.05$ ) decrease in lymphocytes percentage observed during late pregnancy compared to early lactation, whereas monocytes percentage increased ( $P < 0.05$ ) during the early lactation compared to the control and late pregnancy. Late pregnancy and early lactation have a negative influence on the haematological parameters in camels. The data could be utilised to assess the physiological adaptation to pregnancy and lactation in camels.

**Keywords:** *Camels; Haematological Parameters; Late Pregnancy; Early Lactation*

### Abbreviations

TEC: Total Erythrocytes Count; TLC: Total Leukocytes Count; Hb: Haemoglobin; PCV: Packed Cell Volume; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; fl: Femtolitre; pg: picogram; g/dl: gram/ per decilitre; DLC: Differential Leukocytes Count; GLM: General Linear Model; ANOVA: Analysis of Variance

### Introduction

Late pregnancy and early lactation are demanding physiological states that lead to significant changes in the metabolic profile of all animal species [1]. Many researchers defined the period from late pregnancy to early lactation as a transition period that considered as one of the most critical periods for health and productivity in camels [2-7].

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In camels, haematological parameters are the most common indicators to assess metabolic profile during late pregnancy and early lactation and significant variations in the haematological parameters have been reported previously in camels [2,4,8-11]. In Maghrebian female camels [12] reported that PCV and [Hb] decreased significantly during late pregnancy and then the values showed non-significant changes during postpartum months. Higher values of TEC, Hb and PCV have been reported during late pregnancy and early lactation in camels [13]. Furthermore, Significant higher values of neutrophils, MCH and MCHC accompanied by significant lower values of lymphocyte have been reported during the transition period in camels [11]. Moreover, a noticeable neutrophilia reported during the transition period in camels [2].

Few Studies have been conducted to describe the haematological profile of female camels during the transition period [2-4]. Therefore, the present study aimed to provide additional information on the haematological parameters in dromedary camels during late pregnancy and early lactation in comparison to non-pregnant ones.

### Materials and Methods

#### Ethical approval

The study was approved by the authorities at the Camel Research Centre as a routine checkup for monitoring herd health status during the periods November 2016 - February 2017, May and August 2018 and February 2019.

#### Animals and management

Twenty clinically healthy female camels (10 non pregnant and 10 time-mated pregnant camels (aged 8 - 16 year, weight: 600 - 700 kg, body condition score: 2.5 - 3, number of parities: 2 - 3) were used. The animals were selected from the herd of the Camel research Centre of the University of Khartoum, Sudan. Non-pregnant non-lactating female camels were selected under the same conditions to provide the normal values for investigated parameters. Time-mated pregnant camels were selected according to the records of mating time for each female included in the experiment, which indicated the expected time for parturition. The pregnant camels were monitored from late pregnancy up to early lactation. During the experimental period, the female camels were housed in an outdoor environment in a shaded corral. The selected animals were maintained on grazing and browsing trees and shrubs in the vicinity of the Camel Centre and occasionally received fresh grass and concentrate supplements, which was offered daily with free access to fresh water.

#### Sample collection and laboratory analysis

Blood samples were collected once from non-pregnant camels and during late pregnancy and early lactation by jugular venipuncture into collection tubes containing EDTA. The blood samples were used for the determination of haematological parameters (TEC, TLC, Hb, PCV, MCV, MCH and MCHC) using Automated Haematology analyser (URIT-3010 VET, URIT medical electronics). The ratios of lymphocytes, neutrophils, monocytes, eosinophils and basophils (DLC) were determined microscopically from a count of 100 leukocytes in thin Giemsa-stained blood smears.

#### Statistical analysis

Statistical analysis was performed using SPSS for Windows version 20. General Linear Model (GLM), ANOVA (Levine's Test and Post Hoc Test) was used to assess the significant differences among the groups. The difference was considered significant at  $P \leq 0.05$ .

### Results and Discussion

#### Erythrocytes parameters

The effects of late pregnancy and early lactation on the erythrocytes parameters of dromedary camels are shown in table 1 and figure 1. The TEC showed a significant ( $P < 0.05$ ) decrease during late pregnancy compared to the control and early lactation, whereas blood-[Hb] decreased significantly ( $P < 0.05$ ) during late pregnancy, early lactation compared to the control group. This pattern of erythrocytes

parameters response attributed to increased demand for oxygen consumption and the requirements of higher metabolic rate for growth and milk production during late pregnancy and early lactation. Similar results have been observed by [12] who reported higher values of Hb during late pregnancy in Maghrebian female camels. Furthermore, higher values of TEC, Hb and PCV have been reported during late pregnancy and early lactation in camels [2,4,13].

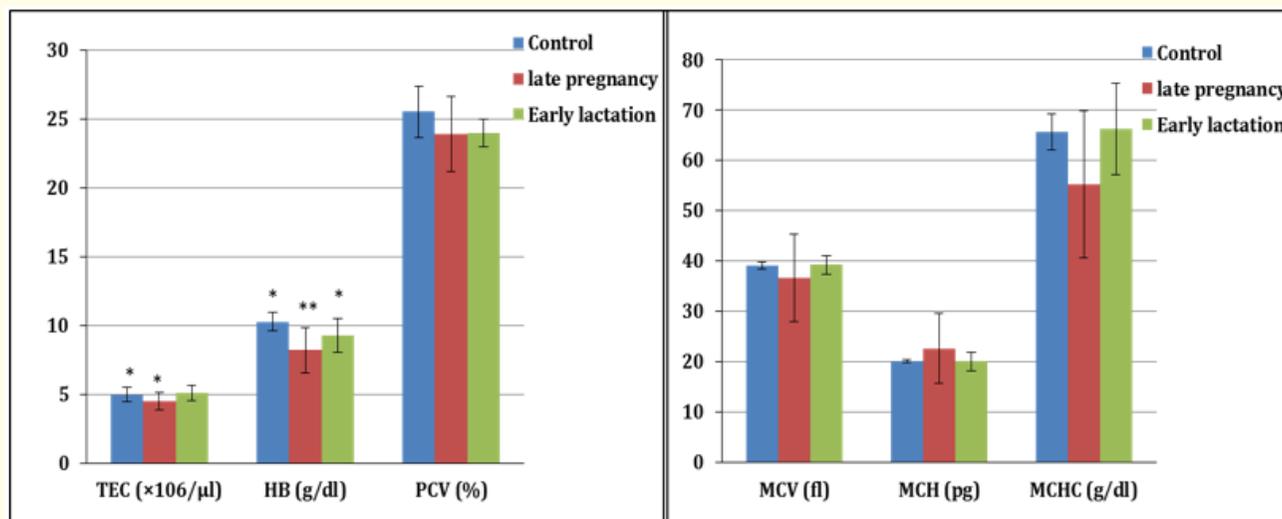
| Parameter                         | Control                       | late pregnancy                | Early lactation               | Level of significance |
|-----------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------|
| TEC ( $\times 10^6/\mu\text{l}$ ) | 4.95 $\pm$ 0.52 <sup>a</sup>  | 4.46 $\pm$ 0.64 <sup>b</sup>  | 5.07 $\pm$ 0.55 <sup>a</sup>  | P < 0.05              |
| Blood- [Hb] (g/dl)                | 10.25 $\pm$ 0.68 <sup>a</sup> | 8.19 $\pm$ 1.67 <sup>b</sup>  | 9.27 $\pm$ 1.26 <sup>c</sup>  | P $\leq$ 0.05         |
| PCV (%)                           | 25.51 $\pm$ 1.90 <sup>a</sup> | 23.91 $\pm$ 2.73 <sup>a</sup> | 24.00 $\pm$ 1.01 <sup>a</sup> | NS                    |
| MCV (fl)                          | 39.1 $\pm$ 0.7 <sup>a</sup>   | 36.7 $\pm$ 8.7 <sup>a</sup>   | 39.2 $\pm$ 1.8 <sup>a</sup>   | NS                    |
| MCH (pg)                          | 20 $\pm$ 0.3 <sup>a</sup>     | 22.6 $\pm$ 6.9 <sup>a</sup>   | 20 $\pm$ 1.8 <sup>a</sup>     | NS                    |
| MCHC (g/dl)                       | 65.6 $\pm$ 3.5 <sup>a</sup>   | 55.2 $\pm$ 14.6 <sup>a</sup>  | 66.3 $\pm$ 9.1 <sup>a</sup>   | NS                    |

**Table 1:** Erythrocytes parameters of female camels (*Camelus dromedarius*) during late pregnancy and early lactation (n = 10).

Means within the same row bearing different superscripts are significantly different at P $\leq$ 0.05.

[Hb]: donate concentration, TEC: Total Erythrocytes Count; Hb: Haemoglobin; PCV: Packed Cell Volume;

MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration.



**Figure 1:** Erythrocytes parameters of female camels (*Camelus dromedarius*) during late pregnancy and early lactation (n = 10).

Bars bearing stars are significantly different at \* P  $\leq$  0.05, \*\* P  $\leq$  0.01.

In the present study the values of PCV, MCV, MCH and MCHC did not attain statistical significance during late pregnancy and early lactation, which can be considered as a good indicator for an optimum management and feeding regime programme during the transition period [4] concluded that the unchanged values of erythrocytes parameters during the transition period in camels can be taken as an indicator of the proper feeding regime and management.

**Leukocytes parameters**

The effects of late pregnancy and early lactation on the leukocytes parameters of dromedary camels are shown in Table 2 and Figure 2. In the present study, the values of TLC and basophils percentage did not attain statistical significance during late pregnancy and early lactation, which can be considered as a good indicator for an optimum monitoring health status during the transition period. On the other hand, the results showed that the neutrophils percentage increased significantly ( $P < 0.01$ ) during the early lactation compared to the control and decreased ( $P < 0.05$ ) compared to late pregnancy. The observed neutrophilia could be attributed as a stress factor that being associated with the initiation of the lactation period. The pattern of leukocytes parameters particularly neutrophilia reported previous in camels [2,4,11].

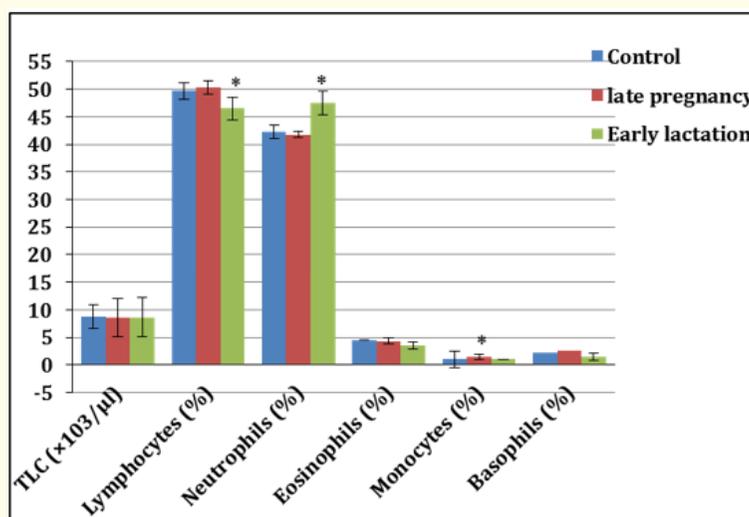
In the present study, significantly ( $P < 0.05$ ) decrease in lymphocytes percentage observed during late pregnancy compared to early lactation, whereas monocytes percentage increased significantly ( $P < 0.05$ ) during the early lactation compared to the control and late pregnancy. The significant changes in neutrophils and lymphocytes and monocytes percentage could be due to cortisol and ACTH release in response to pregnancy and lactation stress [3,14].

| Parameter                         | Control                        | late pregnancy                | Early lactation               | Level of significance |
|-----------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------|
| TLC ( $\times 10^3/\mu\text{l}$ ) | 8.70 $\pm$ 2.14 <sup>a</sup>   | 8.56 $\pm$ 3.48 <sup>a</sup>  | 8.63 $\pm$ 3.50 <sup>a</sup>  | NS                    |
| Lymphocytes (%)                   | 49.67 $\pm$ 1.53 <sup>ab</sup> | 50.25 $\pm$ 1.25 <sup>b</sup> | 46.50 $\pm$ 2.12 <sup>a</sup> | $P < 0.05$            |
| Neutrophils (%)                   | 42.33 $\pm$ 1.52 <sup>a</sup>  | 41.75 $\pm$ 2.06 <sup>a</sup> | 47.50 $\pm$ 2.12 <sup>b</sup> | $P \leq 0.05$         |
| Eosinophils (%)                   | 4.51 $\pm$ 1.23 <sup>a</sup>   | 4.34 $\pm$ 0.53 <sup>a</sup>  | 3.50 $\pm$ 0.70 <sup>a</sup>  | NS                    |
| Monocytes (%)                     | 10 $\pm$ 0.00 <sup>a</sup>     | 1.50 $\pm$ 0.60 <sup>b</sup>  | 10 $\pm$ 0.00 <sup>a</sup>    | $P < 0.05$            |
| Basophils (%)                     | 2.30 $\pm$ 1.50 <sup>a</sup>   | 2.50 $\pm$ 0.50 <sup>a</sup>  | 1.50 $\pm$ 0.70 <sup>a</sup>  | NS                    |

**Table 2:** Leukocytes parameters of female camels (*Camelus dromedarius*) during late pregnancy and early lactation (n = 10).

Means within the same row bearing different superscripts are significantly different at  $P \leq 0.05$ .

Total Leukocytes Count: TLC.



**Figure 2:** Leukocytes parameters of female camels (*Camelus dromedarius*) during late pregnancy and early lactation (n = 10).

Bars bearing stars are significantly different at \*  $P \leq 0.05$ .

### Conclusion

Late pregnancy and early lactation have a negative influence on the haematological parameters in camels. The data could be utilised to assess the physiological adaptation to pregnancy and lactation in camels.

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### Conflict of Interest

The author declares that there was no conflict of interest.

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