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Changes in Hematopoietic Levels and Milk Components during the First Weeks after Labor in the Maghrebi She-Camel

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ABSTRACT

Camels play an important role in social life and the economy. So, the current study was planned to detect the blood constituents and milk components of Maghrebi She-Camel in different parties. Thirty pregnant she-camels were inseminated and became pregnant in this study during the first quarter of 2019; thirteen pregnant she-camel managed to give calving successfully during March 2020. According to multiple parities, they were classified into three groups; (1-2 parities), (3-4 parities) and (5-6 parities). Blood measurements included hematology, substances, ions and milk measurements included yield and components. No significant differences between all groups for all hematological measurements. The overall mean of daily milk production was significantly higher after eight weeks of lactation than at the beginning of lactation. No significant results were shown in milk fat, lactose and protein neither parties nor lactation period. Milk total solid significantly was in its lowest values eight days of parturition for the first and second parties and was at its highest values for the third and fourth parties. A significant difference in ash% was found between experimental parties for the first eight days of lactation and after eight weeks. In general, those insignificant differences in blood parameters, milk productivity and composition might indicate animal health and stability.

Keywords: Blood parameters, Hematopoietic Levels, Maghrebi-She camel, Milk composition.

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INTRODUCTION

According to Food and Agriculture Organization **(FAO, 2009)**, there are about 22 million camels in the World. Of this, 19.58 million are believed to be one-humped dromedary camels (*Camelus dromedarius*), while the remaining 2.42 million are two-humped Bactrian camels (*Camelus bactrianus*). Camels live in vast pastoral areas in Africa and Asia and are divided into two species belonging to the Camelus **(Sisay and Awoke, 2015)**. A camel plays an indispensable role in the social life and economy of the people of arid and semiarid areas. The camel is one of the most neglected species, and very few attempts have been made to characterize its production potential and related parameters under a traditional management system.

In addition to having a high content of long-chain fatty acids, camel milk is a highly rich source of protein with possible anti-microbial and protective properties. Furthermore, camel milk has the specific ability to stop the growth of pathogens because it contains proteins and enzymes that are protective and have unique antibacterial and antiviral qualities, such as lactoferrin, peptidoglycan protein, and lactoperoxidase. **(Faraz, 2020).**

Hematological and biochemical analysis of blood can often provide valuable information regarding the health and sickness of animals. Only limited information on serum biochemistry and hematology of one-humped camel is available. Still, in most of these studies, the numbers of animals used were very low and the animals were from different climatic conditions. Thus, the values obtained in one country could not be considered standard in other countries with different climates **(AL-Busadah, 2007)**. The standard hematological and serum biochemical values need to be determined in a number of animals in variable environmental conditions.

Camel milk is unique from other ruminant milk in terms of composition as well as functionality, as it contains a high concentration of immunoglobulins and insulin. It is high in vitamins (A, B-2, C and E) and

minerals (sodium, potassium, iron, copper, zinc and magnesium) and low in protein, sugar and cholesterol (4,5). Vitamins in camel milk have antioxidant activity and are helpful in controlling tissue damage caused by harmful substances. In addition, camel milk has a higher storage room temperature capacity than milk from other animals (**Sakandar *et al.*, 2018**). So, the current study was planned to explore the blood constituents and milk components of Maghrebi She-Camel in different parties.

MATERIALS AND METHODS

The present study was conducted in the Department of Animal Biotechnology, Animal Production Research Institute, Egypt. The present work was carried out in the Private Camels Farm, Marsa Matrouh Governorate, located in the North of Egypt, the closest area to the western border of Egypt. The studies started during this experiment and extended from March to May 2020.

Animals and Diet

Thirteen pregnant Maghrebi she-camels (*Camelus dromedarius*) were conserved from thirty healthy varying ages Maghrebi she-camels. They were placed in the wide pen and wide paddock for exercising. The average of the Thirteen Maghrebi she-camels body weight was 560 kg. The ration per animal was offered twice daily at 8 am and 6 pm. The ration consisted of 7 kg of a forage mixture of barley straw *(Hordeum vulgare)* and 5-6 kg of a commercial feed concentrate mixture (12% CP). After parturition, the thirteen viviparous She-camel were used to investigate the udder measurements around the milking, milk vain, and milk yield eight weeks after parturition. The rations were submitted to the farm's customary regime without methodological interference.

Experimental design

Thirty Maghrebi she-camels were naturally inseminated during the first quarter of 2019; a thirteen-pregnant she-camel successfully gave calving in March 2020. According to multiple parities, they were classified into three groups. The groups were arranged into (1-2 parities), (3-4 parities) and (5-6 parities). The distribution of the thirteen she-camels in the groups was 6, 4, and 3, respectively. Animals were subjected over a period of eight weeks after calving to several measurements represented in the recording of blood measurements, including hematology, substances (Hemoglobin, total protein, globulin albumin, A/G ratio, cholesterol, LDL and HDL) ions (Calcium, Sodium and Potassium) and milk measurements included yield and components (Fat%, protein%, lactose%, total solids% and ash). The measurements were taken in the morning twice during the eight weeks, after the passage -of the colostrums period (8 days after calving), till the end of the eight weeks. The atmospheric temperature ranged between 17-21C^{o} with 30- 45% relative humidity.

Blood samples

The blood samples were collected from the Jugular vein in the morning before feeding. Blood samples were collected in tubes containing EDTA and divided into two portions. The first portions were taken to determine hemoglobin concentration (g/dl) Hematocrit value HEMATOCRIT (%). The second part was centrifuged at 3000 rpm for 15 min. Clear plasma was carefully drawn into micro covets and stored at -20 ºC until the analysis of total protein, albumin, globulin, cholesterol, HDL, LDL sodium, potassium and calcium.

Blood Parameters

Hemoglobin concentration was determined in fresh blood samples using a haemoglobin meter according to **Tietz (1982)**. Haematocrit value (%) was estimated by a haematocrit capillary tube and centrifuged at 3000 rpm for 20 minutes. Hematocrit values were read and recorded according to **Wintrobe (1965)**.

Blood plasma components

Total protein was determined colourimetrically according to Biuret method as described by **Welchselbaum (1946)**. Albumin concentration was determined colourimetrically according to **Weis (1965)**. Globulin levels were calculated by subtracting albumin content from the total protein values. Sodium, calcium and potassium concentrations were determined colourimetrically according to the method described by **Tabata Trinder (1951); Murachi (1983)**; **Sunderman Jr. and Sundarman (1958).** Meanwhile, Cholesterol concentrations were quantitatively determined using the kit provided by Agappe Diagnostic Company, Switzerland, as described by **(Allain, *et al.*, 1974)**. Whereas High-density lipoproteins (HDL) were provided by Biomerieux Company, France kit as described by **(Kostner, 1976)**. On the other hand, Low density of lipoproteins (LDL) was calculated by the equation LDL = cholesterol-HDL, as described by **Abdul-Rahaman, *et al*., (2018).**

Milk yield and composition

Estimating daily milk production was done from the eighth day of birth until the end of the eighth week of lactation. Milking was done manually twice at (07:00h) and (19:00h). The calves were accompanied to their dams, where the udder of the she-camel was tied in the middle of the night before the day of estimating the milk yield. At the time of milking, the calves are allowed to suckle their dams to stimulate the secretion of milk, and then it is removed after the start of flowing the milk until the completion of handily

milking in a plastic bucket. It is estimated by weight and then by volume using a graduated cylinder. And taking into account that the specific density is approximately equal to one, the average of the two measures was calculated to adopt the milk yield data. After estimating the amount of milk, calves are left in their dams until the next measure time.

Milk Samples (30 ml) were collected from each lactating camel at milking time in clean glass bottles. The samples collected from morning and evening were pooled for each animal and analyzed for milk composition and physical characteristics throughout the lactation period. Whole milk samples were stored frozen at−20◦C without adding preservatives. The samples were warmed to 40°C in a water bath and held at this temperature for 15 min for detection of protein, fat, lactose, total solids and ash using Lactoscan (Ultrasonic Milk Analyzer).

Statistical analysis

Data obtained were tabulated and statistically computed by SAS (SAS version 9.0, SAS Inst. Inc., Cary, NC). Analysis of the variance procedure and Duncan's Multiple Range test were used to detect significant differences among means.

RESULTS

Blood Parameters

Current data results showed no significant differences between all groups even at neither the start nor the end of lactation periods for all hematological measurements as presented in table (1) and table (2). The highest HEMATOCRIT% overall was found in the first 8 weeks of lactation, 29.9%, then at the end of eight weeks (28.9%). Similar results were found for hemoglobin which was at was11.6g/dl at the beginning of lactation and 11.3g/dl at the end of eight weeks of lactation.

As presented in table (1), no significant differences were found for total protein albumin and globulins, which were higher in its overall mean eight days after parturition (7.66, 4.30 and 3.35mg/dl) than at the end of the lactation period (7.46, 4.22 and 3.24 mg/dl). Similarly, there were no significant differences for cholesterol, HDL, or LDL overall mean concentrations as shown in table (2), which were higher eight weeks of lactation period (51.5, 14.3 and 10.05mg/dl) than eight days of parturition (19.0, 14.3 and 10.05mg/dl).

Calcium concentrations did not significantly differ in their overall mean, which was higher eight days after parturition than eight weeks of lactation (7.0*vs.* 6.79 mg/dl). Meanwhile, sodium concentration was lower at eight weeks of parturition than at eight weeks of lactation (160.6 *vs.*162.9 mg/dl). Potassium concentration showed no differences in overall mean concentrations.

Milk yield and composition

All results of daily milk production and milk composition are presented in table (3). At the first eight days of lactation, no significant difference was found in total milk yield, which was at its lowest value in the first and second parties (1.18kg/d); meanwhile, the maximum production was found in the fifth and sixth parties (1.51kg/d), however after eight weeks of lactation the first and second parties milk production (3.39kg/d) significantly lower than three and four and fifth and sixth parties (3.81 and 33.92kg/d resp.).

Table 1: The variation (mean ± S.E) of Maghrebi she–camels blood hematology measurements among parities in the first and eighth weeks after parturition

Times	Multiple parities	Blood hematology					
		Hematocrit (%)	Hb (g/dl)	TP (mg/dl)	Albumin (mg/dl)	Globulin (mg/dl)	A/G Ratio
The eighth day after parturition	1-2 parities	29.75 ± 0.59	11.60 ± 0.38	7.90 ± 0.40	4.51 ± 0.17	3.38 ± 0.25	0.74 ± 0.04
	3-4 parities	30.50 ± 0.72	12.15 ± 0.46	7.67 ± 0.49	4.20 ± 0.21	3.47 ± 0.31	0.82 ± 0.05
	5-6 parities	29.63 ± 0.83	11.20 ± 0.53	7.16 ± 0.56	4.03 ± 0.24	3.13 ± 0.36	0.79 ± 0.06
	Overall mean	29.95 ± 0.38	11.67 ± 0.25	7.66 ± 0.26	4.30 ± 0.12	3.35 ± 0.16	0.78 ± 0.02
End of the eighth week after parturition	1-2 parities	28.73 ± 0.59	11.21 ± 0.38	7.70 ± 0.40	4.35 ± 0.17	3.35 ± 0.25	0.76 ± 0.04
	3-4 parities	29.45 ± 0.72	11.67 ± 0.46	7.45 ± 0.49	4.25 ± 0.21	3.20 ± 0.31	0.74 ± 0.05
	5-6 parities	28.50 ± 0.83	10.96 ± 0.53	7.03 ± 0.56	3.93 ± 0.24	3.10 ± 0.36	0.78 ± 0.06
	Overall mean	28.90 ± 0.38	11.30 ± 0.25	7.46 ± 0.26	4.22 ± 0.12	3.24 ± 0.16	0.76 ± 0.02

Table 2: The variation (mean ± S.E) of Maghrebi she–camels blood substances and ions among different parities in the first and eighth weeks after parturition

Times	Multiple parities	Biochemical profile					
		Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	Calcium (mg/dl)	Sodium (mg/dl)	Potassium (mg/dl)
The eighth day after parturition	1-2 parities	47.16 ± 5.73	14.46 ± 1.39	9.40 ± 0.93	7.05 ± 0.76	158.85 ± 4.35	4.51 ± 0.09
	3-4 parities	48.00 ± 7.02	14.20 ± 1.71	9.60 ± 1.14	7.07 ± 0.93	160.30 ± 5.33	4.50 ± 0.11
	5-6 parities	54.00 ± 8.10	14.20^{a} ± 1.97	11.96 ± 1.31	6.80 ± 1.07	164.53 ± 6.15	4.40 ± 0.13
	Overall mean	49.00 ± 3.64	14.32 ± 0.86	10.05 ± 0.65	7.00 ± 0.47	160.60 ± 2.78	4.48 ± 0.05
End of the eighth week after parturition	1-2 parities	49.16 ± 5.73	14.46 ± 1.39	9.50 ± 0.93	6.93 ± 0.76	161.23 ± 4.35	4.51 ± 0.09
	3-4 parities	51.50 ± 7.02	14.05 ± 1.71	9.67 ± 1.14	6.82 ± 0.93	162.22 ± 5.33	4.47 ± 0.11
	5-6 parities	56.33 ± 8.10	13.93 ± 1.97	12.26 ± 1.31	6.46 ± 1.07	167.40 ± 6.15	4.40 ± 0.130
	Overall mean	51.53 ± 3.64	14.21 ± 0.86	10.19 ± 0.65	6.79 ± 0.47	162.96 ± 2.78	4.47 ± 0.05

In general, the overall mean of daily milk production is significantly higher after eight weeks of lactation (3.64kg/d) than at the beginning of lactation (1.34kg/d), as illustrated in the table (3). However, lactose percent shows a significant difference among parties at the first eight days of lactation, which were 4.14% for third and fourth parties than first and second and fifth and sixth parties (3.24 and 4.49% resp.) but generally, there is no significant difference in lactose % between the beginning and the end of lactation.

Table 3: The variation (mean ± S.E) of Maghrebi she–camels milk yield and components among different parities in the first and eight weeks after parturition

Times	Multiple parities	Milk components					
		Daily milk yield	Fat %	Protein %	Lactose %	Total solids %	Ash %
The eighth day after parturition	1-2 Parities	1.18^{c} ± 0.10	3.22^{a} ± 0.24	2.51^{a} ± 0.15	3.21^{a} ± 0.25	9.96^{b} ± 0.29	0.73^{b} ± 0.02
	3-4 Parities	1.44^{c} ± 0.12	3.94^{a} ± 0.29	2.99^{a} ± 0.18	4.10^{ba} ± 0.30	12.43^{a} ± 0.36	0.91^{a} ± 0.03
	5-6 Parities	1.51^{c} ± 0.14	3.49^{a} ± 0.34	2.77^{a} ± 0.21	4.48^{a} ± 0.35	11.47^{a} ± 0.42	0.81^{ba} ± 0.04
	Overall mean	1.34^{b} ± 0.08	3.50^{a} ± 0.17	2.72^{a} ± 0.11	3.78^{a} ± 0.22	11.07^{a} ± 0.36	0.80^{a} ± 0.02
End of the eighth week after parturition	1-2 parities	3.39^{b} ± 0.10	3.20^{a} ± 0.24	2.51^{a} ± 0.15	3.24^{a} ± 0.25	9.96^{b} ± 0.29	0.72^{b} ± 0.02
	3-4 parities	3.81^{a} ± 0.12	3.94^{a} ± 0.29	2.98^{a} ± 0.18	4.12^{ba} ± 0.30	12.41^{a} ± 0.36	0.89^{a} ± 0.03
	5-6 parities	3.92^{a} ± 0.14	3.47^{a} ± 0.34	2.78^{a} ± 0.21	4.49^{a} ± 0.35	11.42^{a} ± 0.42	0.80^{ba} ± 0.04
	Overall mean	3.64^{a} ± 0.08	3.49^{a} ± 0.17	2.72^{a} ± 0.11	3.80^{a} ± 0.22	11.05^{a} ± 0.36	0.79^{a} ± 0.02

This means bearing the different letters within the same classification, significantly different ($P<0.05$).

Milk total solid was at its lowest value (*P<0.05*) eight days of parturition for the first and second parties (9.96%), where was in its highest value at the third and fourth parties (12.43%) as shown in table (3). Similar results were found for the end of the lactation period which was in its higher value at the third and fourth parties than other groups. But generally, no significant difference between both lactation periods.

A significant difference in ash% was found between experimental parties for both the first eight days of lactation and after eight weeks of lactation, which was in its lowest values at the first and second parties (0.73%) and was high in the third and fourth parties (0.91%) at the beginning of lactation. Similarly, after eight weeks of lactation, ash% was significantly higher (0.89%) in the third and fourth parties than in other groups. However, the overall mean of ash% did not show a significant difference between the first eight days and the end of eight weeks of lactation.

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DISCUSSION

Current results of HEMATOCRIT% were confirmed by **Tharwat*et al.,* (2015)** who found no significant differences in HEMATOCRIT% at the first three weeks of lactation which ranged between 24.2-25.9%. Similar confirmation was reported for Hb 12.43g/dl with no significant differences between lactating and non-lactating she-camel **(Ayoub *et al.,* 2003**). Generally, mean ± SEM values of salient the haamatological parameters for both male and female camels (*Camelus Dromedarius*) are non-significant (**Farooq *et al.,* 2011**).

El-Harairy, *et al.,* (2019) reported similar results for plasma proteins and found no significant differences for total protein, albumin and globulins for the first and second parties with the fourth parity. Meanwhile, a significant difference was found for the fifth and sixth parity (7.06, 3.5 and 3.4 g/dl resp.). This phenomenon was found in lactating sows **(Bequette *et al.,* 1998)**; the synthetic rate for mammary constitutive proteins increases to a peak level on d 14 of lactation (7.8 g/kg wet tissue/d) and then decreases to 2.7 g/kg wet tissue/d on d 21 and 0.5 g/kg wet tissue/d on d 28 of lactation. On the other hand, no significant differences between parties were found for the albumin globulin ratio (A/G). Furthermore, there are no differences for those parameters among different body weights and no significant differences among animal sex or breed (**AL-Busadah*et al.,* 2007)**.

For lipids, current results were confirmed by **AL-Busadah*et al.,* (2007)** who found no significant difference among groups. In agreement with **Megahed*et al.,* (2012)** who found that HDL values ranged between 15.67 and 23.69 mg/dl in healthy pregnant and non-pregnant she-camel where LDL was 6.02 and 7.47 mg/dl with no significant difference.

Tharwat*et al.,* (2015) reported that calcium concentrations did not differ significantly among all the tested time points three weeks pre- and post-partum. Meanwhile, Potassium concentrations significantly differ during different seasons, ranging between 2.04 to 7.19 mEq/l. While sodium concentrations did not significantly differ between males and females among different breeds which ranged between 140.0 and 160.3 mmoL/L (**AL-Busadah*et al.,* 2007**).

Mostafa *et al.,* (2018) reported similar results for the daily milk production of first and second parties was significantly lower than third and fourth, fifth and sixth parities. Those results were confirmed by **Musaad *et al.,* (2013)**, who illustrated that the lowest milk yield (P<0.05) was recorded at the first and ninth parities, whereas the highest milk yield was observed at the sixth and eighth parities.

No significant results were shown in milk fat and protein, neither parties nor lactation period. **Mustafa *et al.,* (2021)** recorded no difference in fat % and protein% among young and old she-camel groups. Generally, Fat % increased regularly from weeks 2 to 8 of lactation. **Elobied *et al*., (2015)** studied camel milk lactose % in five parties and found no significant difference with a range of 4.32-4.61%. On the contrary, **Mohamed and El Zubeir, (2020)** recorded higher significant means of second parity than third. That difference might be due to the Synthesis of α-lactalbumin; therefore, lactose does not begin until Stage 2 of lactogenesis. The mammary glands enter Stage 1 lactogenesis in days or weeks (**Rezaei, *et al.,* 2016**).

Our results agreed with **Dowelmadina *et al.,* (2014)** who confirmed these findings when they found no significant difference in milk total solids% between parties and within parties (from one to fifth) in Kenana she-camel breed. However, Data presented by **Ashour *et al.,* (2019)** showed a significant effect of parity number on milk total solids% which decreased with the progress of the parities in both the early-lactation, mid-lactation and late-lactation through the different lactation stages. Milk fat and total solids were significantly higher in early lactated and non-pregnant females compared to late lactated and pregnant she-camels **(Faraz 2020).**

Data presented by **Ashour *et al.,* (2019)** confirmed those results showed that; the effect of parity number (from one to fifth) on milk ash % of the

Maghrebi she-camels was significantly (P<0.05) increased with the advancing parities either early-lactation, mid-lactation or the late-lactation of the lactation period. In addition, the milk ash% content of the Maghrebi she-camels was insignificantly lower at the early lactation than at the mid-lactation and the late-lactation. **Seioudy (2013)** recorded similar trends and found that the total ash varied from 0.05 to 0.89%, averaging 0.69±0.11%.

In general, our results are contrary to those found by **Ahmed et *al.*, (2015)** who recorded significant (p≤0.05) variations in milk constituents between different parities (from one to six). However, current results are in agreement with **Babiker and El Zubeir, (2014)** who reported non-significant (p≥0.05) variations between parities, although, they reported quantitative variation.

CONCLUSION

In conclusion, this stability of blood parameters could be an indicator of the overall health of the she-camel studied groups. It appears that the she-camel can maintain its blood parameters stable in order to meet its milk production requirements. To satisfy the increasing needs of their newborn calf, milk production and components are not generally varied. Those findings have been stated in numerous research results that confirmed the remarkable ability of the she-camel to maintain its physiological parameters as close to slandered levels as possible. As a result, large-scale research plans on large numbers of She-camels are required to confirm this steady-state capability.

Conflicts of interest

The authors declared no competing interests.

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