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HAEMATOBIOCHEMICAL PROFILE IN FEMALE CAMELS (*Camelus dromedarius*) DURING THE PERIPARTURIENT PERIOD

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ABSTRACT

The aim of the present study was to investigate the influence of the periparturient period on the haematological and biochemical profiles in female camels. For this purpose, blood samples were collected from 10 female camels during the periparturient period (3 wk before to 3 wk after parturition; wk -3, -2, -1, 0, +1, +2 and +3). None of the camels showed any evidence of clinical disease around parturition. The most important haematological abnormality was the increased neutrophil count during the first 2 wk after parturition. The globulin concentration increased significantly at wk +3 after parturition (P=0.03). The phosphorus and magnesium concentrations increased significantly at wk -2 and +3, respectively. The serum activity of aspartate aminotransferase (AST), γ-glutamyl transferase (GGT) and alkaline phosphatase (ALP) was significantly elevated at wk 1 after parturition. The serum activity of GGT and ALP remained also high during the 2nd week after parturition. Glucose concentration increased significantly at wk 0 and wk +1 post-partum. The creatinine concentrations decreased significantly at wk 1 post-partum. Cortisol concentration increased significantly at parturition (wk 0). Oestrogen concentration increased significantly at wk -2, -1 and 0, but decreased significantly at wk 1, 2 and 3. Progesterone concentrations increased significantly at wk -2 and decreased at wk 0, 1, 2 and 3. Other tested parameters did not differ significantly pre- and post-partum. In conclusion, the haematobiochemical variables reported in this study could be used as a reference for female camels during the periparturient period.

Key words: Biochemistry, camel, haematology, peripartum, transition period

Severe economic losses due to impaired production and reproductive performance can result from the suboptimal transition of the pregnant animal from the late-gestation period to lactation (Drackley, 1999; Overton and Waldron, 2004). Therefore, the periparturient period is the most stressful time in the production cycle of a dairy cow because of depressed feed intake and endocrine and metabolic changes at parturition. Optimal transition requires a comprehensive understanding of the biochemical events occurring during the periparturient period (Guo *et al,* 2007).

The periparturient or transition period defined as 3 wk before to 3 wk after parturition, is characterised by marked changes in an animal's endocrine status that are much more dramatic than at any other time in the lactation–gestation cycle, as well as, by a reduction in feed intake when nutrient demand for the developing conceptus and the impending lactogenesis are increasing (Drackley, 1999). During the transition phase in bovines, the animal has to adapt to a dramatic and several-fold increase in nutrient uptake by the mammary gland associated with lactogenesis compared with the much smaller nutrient requirement in late gestation by the growing conceptus (Tharwat *et al,* 2012).

In female dromedary camels, the periparturient period has gained little attention and most of the available data describing metabolism during the transition phase were based on only a few measurements (Leon *et al,* 1990; Riveros *et al,* 2009). More frequent sampling and measurement of blood metabolites should be used to capture the dynamic changes in the periparturient period. The present study was therefore designed to gain detailed information on other commonly measured haematological and biochemical analytes in female camels during the periparturient period.

Materials and Methods

Camels

The experimental protocol was approved by the Animal Ethical Committee, Deanship for Scientific

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Research, Qassim University, Saudi Arabia. Ten multiparous pregnant female dromedary camels reared at Qassim University Farm were enrolled in this study. Their mean body weight was 450 kg (range: 380-560 kg) and their mean age was 8-9 years (range: 7.5-11.0 years). Their body condition score ranged from 3.0 to 3.5 (scales 1 to 5, Sghiri and Driancourt, 1999). The camels were considered healthy on the basis of physical examination (auscultation of the heart, lungs, rumen and intestine and measurement of heart rate, respiratory rate and rectal temperature) (Rosenberger, 1990; Radostits *et al,* 2000) and laboratory evaluation (normal complete blood cell counts and biochemistry panel). All camels were maintained in a free-stall barn and kept under the Laboratory Animal Control Guidelines of Qassim University, which basically conform to the Guide for the Care and Use of Laboratory Animals of the National Institutes of Health in the USA (NIH publications No. 86 to 23, revised 1996).

Blood sampling

Blood samples were collected from each camel at 3 wk, 2 wk and 1 wk before (wk -3, wk -2, wk -1), within 12 h of parturition (wk 0) and 1 wk, 2 wk and 3 wk (wk +1, wk +2, wk +3) after parturition. At each time, two blood samples were collected by puncture of the jugular vein, one on EDTA and the other without an anticoagulant.

Haematological analysis

A complete blood count (CBC) [total and differential leukocytic count, erythrocyte, haematocrit, haemoglobin, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC)] was carried out on the EDTA sample using the VetScan HM5, Abaxis, California, USA. The 2nd blood sample was centrifuged at 1200 × g for 10 min and the serum samples obtained were aliquotted in tubes and immediately stored at -20°C for the clinical chemistry analysis.

Biochemical analyses

Using commercially available kits, the serum samples were used to determine the serum concentrations of total protein, albumin, globulin, calcium, phosphorus, magnesium, blood urea nitrogen (BUN), creatinine and glucose. The serum activity of γ-glutamyl transferase (GGT), aspartate aminotransferase (AST), creatine kinase (CK) and alkaline phosphatase (ALP) were also measured. A fully-automated open-system biochemistry analyser was used for the biochemical analytes (Biosystems A15, Spain).

Oestrogen, progesterone and cortisol were determined in serum samples using electro-chemiluminescent immunoassay kits (Roche Diagnostics, Indianapolis, Indiana, USA), with a measuring range of 5.00 to 4300 pg/mL, 0.030 to 60.00 ng/mL, and 0.018 to 63.4 µg/dL, respectively. The intra- and inter-assay coefficients of variance for oestrogen, progesterone and cortisol were 3.7% and 3.8%, 2.2% and 5.0% and 1.22% and 1.54%, respectively.

Statistical analysis

The data were analysed for period effects using repeated measure analysis of variance, with Fisher's protected least significant difference (LSD) as the post-ANOVA test. The level of significance was tested

Table 1. Haematological parameters (mean ± SEM) in female dromedary camels during the periparturient period (n=10).

Parameter	3wk	-2wk	-1wk	0wk	1wk	2wk	3wk	P value
White blood cells ($\times10^9$/L)	16.9±1.9	15.0±2.0	16.2±1.9	17.4±1.7	20.5±0.2	21.64±2.002	18.201±0.2	0.2
Lymphocytes ($\times10^9$/L)	4.6±0.5	3.8±0.5	3.2*±0.5	1.7*±0.5	2.6±0.4	3.39±0.5	3.59±0.4	0.009
Monocytes ($\times10^9$/L)	0.6±0.2	0.7±0.16	0.4±0.2	0.6±0.15	0.5±0.16	0.51±0.15	0.48±0.16	0.8
Neutrophils ($\times10^9$/L)	11.0±1.6	10.0±1.8	11.3±1.3	15.0±1.2	16.0*±1.1	18.28*±1.8	12.37±1.4	0.01
Eosinophil ($\times10^9$/L)	0.7±0.3	0.5±0.4	1.2±0.3	0.13±0.3	1.3±0.2	1.01±0.4	0.99±0.3	0.18
Red blood cells ($\times10^{12}$/L)	10.6±0.5	10.7±0.5	10.2±0.5	9.6±0.5	10.1±0.6	9.5±0.4	9.6±0.4	0.5
Haemoglobin (g/dL)	16.1±1.1	15.9±1.1	16.2±1.0	13.9±1.2	16.1±1.2	16.9±1.1	16.1±1.2	0.6
Hematocrit (%)	27.4±1.2	26.9±0.9	25.7±1.2	24.6±1.2	25.9±1.1	24.2±1.3	24.6±1.2	0.4
Mean corpuscular volume (fl)	26.0±0.8	25.5±0.7	25.5±0.7	25.8±0.6	25.8±0.8	25.6±0.8	25.5±0.6	0.9
Mean corpuscular haemoglobin (pg)	15.3±0.6	15.0±0.5	16.1±0.5	14.8±0.6	15.9±0.4	17.5*±0.4	15.6±0.6	0.03
Mean corpuscular haemoglobin concentration (g/dL)	58.9±2.3	59.3±2.3	63.8±2.1	57.12±2.3	61.9±2.2	68.4*±2.2	58.9±2.3	0.03
Platelets ($\times10^9$/L)	229.4±37.1	321.6±36.9	270.6±36.5	246.9±38.2	169.5±37.6	308.8±36.4	227.4±37.7	0.08

at P<0.05. A statistical program (SPSS, 2009) was used to perform the statistical analysis.

Results

At parturition, none of the 10 camels showed any evidence of clinical disease. Table 1 summarises the haematological variables during the periparturient period. The total white blood cells revealed non-significant differences among all tested time points (wk -3, -2, -1, 0, 1, 2, 3) (P=0.2). Lymphopenia was observed at -1 and 0 time points (P=0.009) and neutrophilia at wk 1 and wk 2 post-partum (P=0.01). Monocyte and eosinophils did not differ significantly during the periparturient period (P=0.8 and 0.18, respectively). The red blood cells, haemoglobin, hematocrit, platelets and MCV did not differ significantly (P>0.05). On the other side, the MCH and MCHC increased significantly at wk 2 after parturition (P=0.03).

Fig 1 illustrates serum concentrations of total protein, albumin and globulin. The total protein and albumin concentrations did not differ significantly among all the tested time-points pre- and post-partum (P>0.05). However, globulin concentration increased significantly at wk ±3 after parturition (P=0.03). The serum concentrations of calcium, phosphorus and magnesium are shown in Fig 2. Calcium

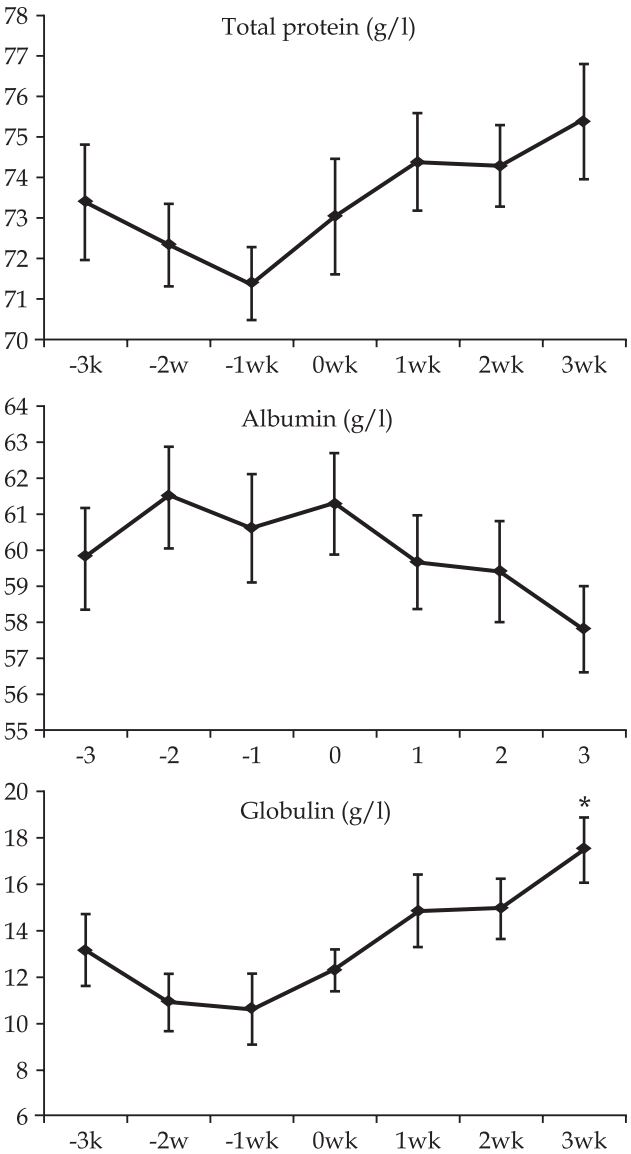

Fig 1. Serum concentrations of total protein, albumin and globulin in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

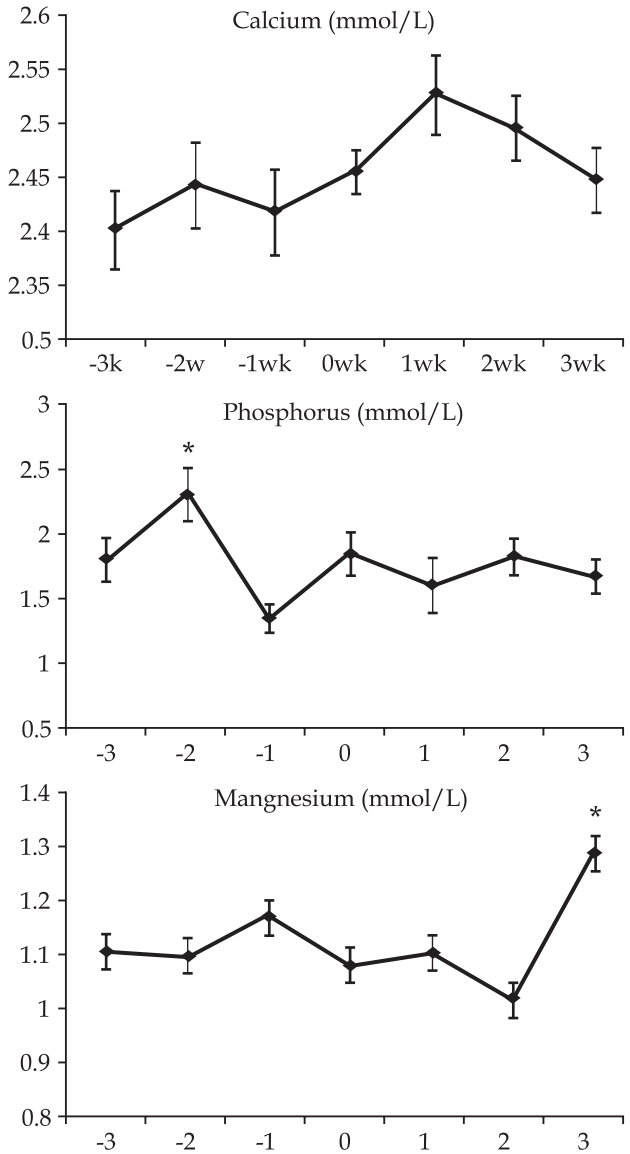

Fig 2. Serum concentrations of calcium, phosphorus and magnesium in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

concentrations did not differ significantly among all the tested time-points pre- and post-partum (P=0.22). The phosphorus and magnesium concentrations increased significantly at wk -2 and ±3, respectively (P=0.01 and 0.03). Fig 3 draws serum activity of AST, GGT and ALP. All of these enzymes increased significantly at wk 1 after parturition (P=0.0001). The serum activity of GGT and ALP remained also high during the second week after parturition (P=0.0001).

Fig 4 shows the serum concentration of glucose and activity of CK. Glucose concentration increased significantly at wk 0 and wk 1 post-partum (P=0.0001). On the contrary, the serum activity of CK did not differ significantly pre- and post-partum (P=0.3). The serum concentration of BUN and creatinine are illustrated in Fig 5. BUN concentrations did not show any significance pre- and post-partum (P=0.05). However, creatinine concentrations decreased significantly at wk 1 post-partum (P=0.01). Fig 6 shows the serum concentrations of cortisol, oestrogen and progesterone. Cortisol concentration increased significantly at parturition (P=0.0001). Oestrogen concentration increased significantly at wk -2, -1 and 0, but decreased significantly at wk 1, 2 and 3 (P=0.0001). Progesterone concentrations increased significantly at wk -2 and decreased at wk 0, 1, 2 and 3 (P=0.0001).

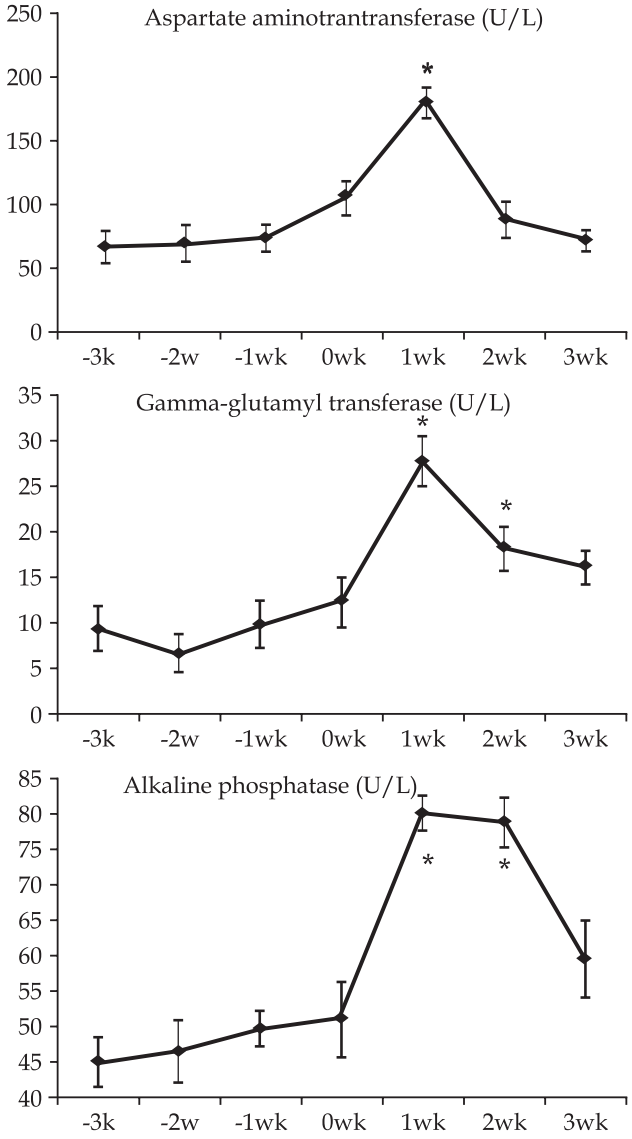

Fig 3. Serum concentrations of aspartate aminotransferase, γ-glutamyl transferase and alkaline phosphatase in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

Discussion

Unlike the transition period in cows, the periparturient period in dromedary camels has gained very little attention. The effect of the transition period on hormonal changes during pregnancy, parturition and post-partum has been reported in guanacos (*Lama guanicoe*) and in the llama (*Lama glama*) (Leon *et al,* 1990; Riveros *et al,* 2009). Through laboratory profiling, not only can sick animals be detected, but also those herds at higher risk of developing metabolic, reproductive or infectious

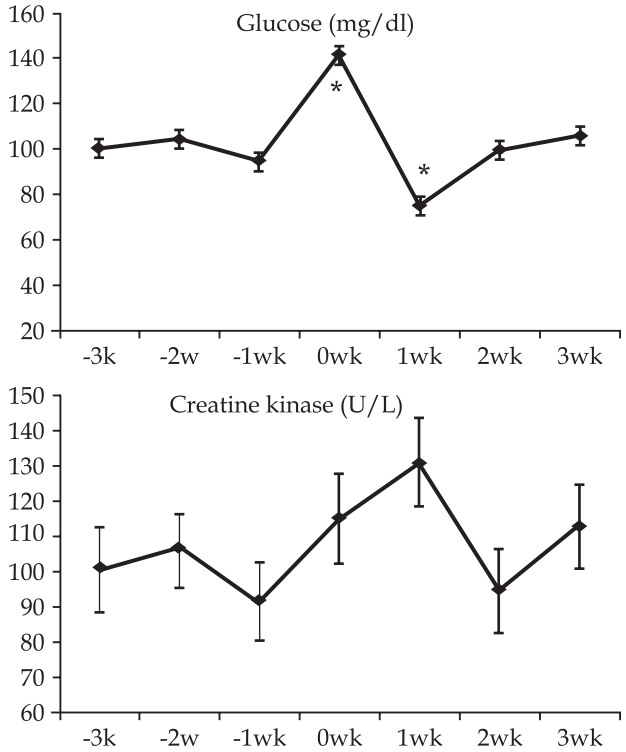

Fig 4. Serum concentrations of glucose and creatine kinase in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

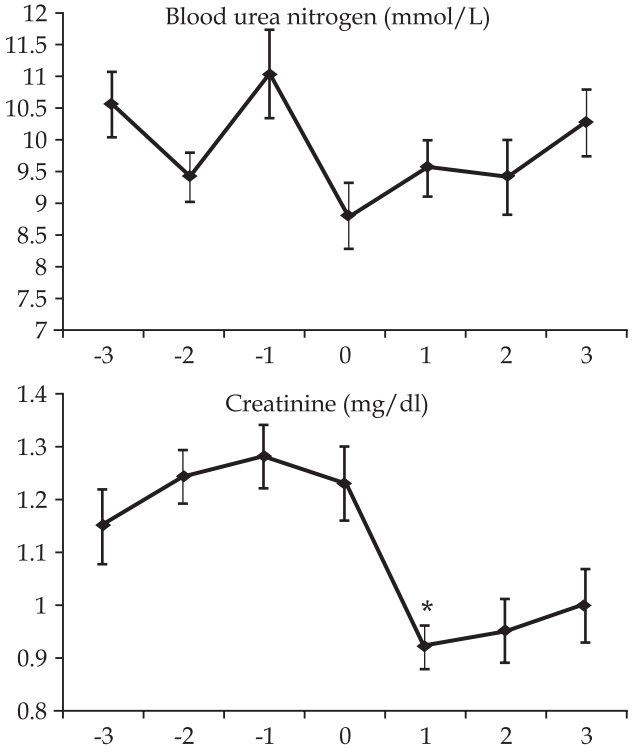

Fig 5. Serum concentrations of blood urea nitrogen and creatinine in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

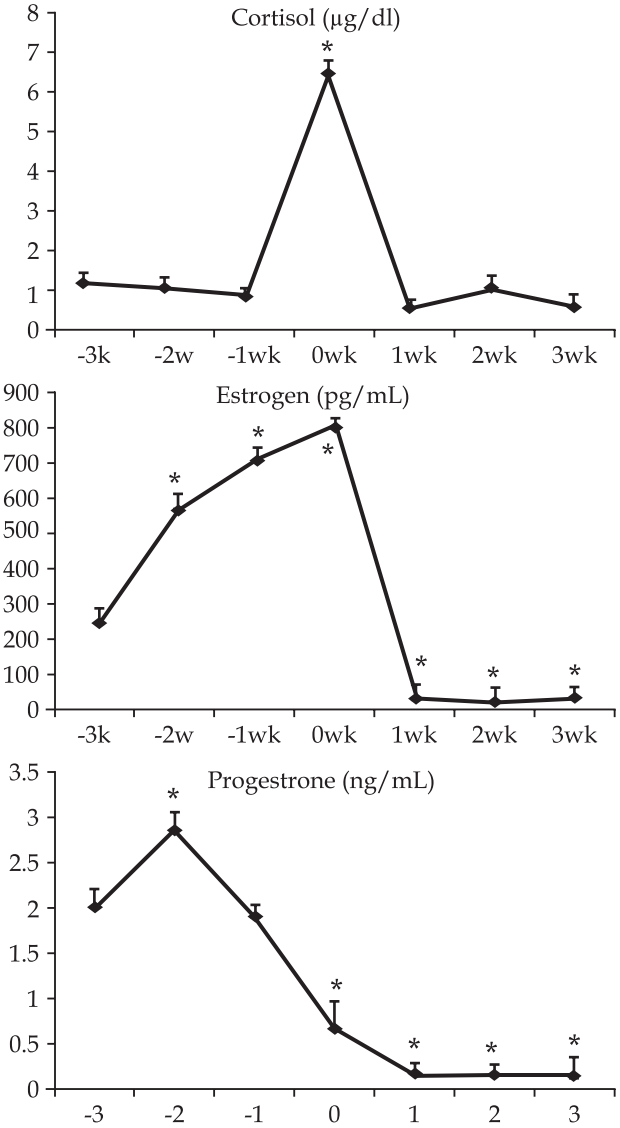

Fig 6. Serum concentrations of cortisol, oestrogen and progesterone in female camels (n=10) during the transition period. Blood samples were collected 3 weeks before parturition (-3, -2, -1), within 12h of parturition (0) and for the following 3 weeks after parturition (1, 2, 3).

diseases may be identified. Therefore, to capture the extensive pre- and post-parturient metabolic changes, we sampled 10 female pregnant dromedary camels from 21 d before anticipated parturition to 21 d after parturition. In addition to the above published variables, the objective of this study was to evaluate other commonly measured biochemical and haematological analytes, especially serum proteins, hepatic and renal functions, the macro-minerals calcium, phosphorus and magnesium, as well as the complete blood picture.

It is well known that there are profound physiological changes in certain analytes pre- and post-parturition. These changes are not necessarily indicative of disease but reflect physiological variations. The most important haematological changes in the female camels during the periparturient period were the detected neutrophilia post-partum (wk 1 and 2). These changes were also reported in cattle during the periparturient period, and may have resulted from the stress associated with parturition and lactation (El-Ghoul *et al,* 2000). The globulin, but not albumin, increased post-partum may be resulting from the formation of immunoglobulins. Similar findings in dairy cows have been reported recently (Tharwat *et al,* 2012). Albumin is an indicator of liver function; it decreases in the peripartum period and its reduction could be associated with hepatocellular liver diseases and fatty liver (Nehra *et al,* 2001). However, its reduction in this study was not significant.

In the present study, there was a significant elevation in the serum activity of AST, GGT and ALP in the female camels post-partum. This may be attributed to triglyceride accumulation in the liver, as reported in cows (Tharwat *et al,* 2012). Unfortunately, in this study, we did not estimate the hepatic triglyceride accumulation to confirm the elevated serum activity of AST, GGT and ALP.

The elevated serum activity of ALP in the camels prepartum may also be explained by the increased placental production of this enzyme, as reported for cows (Peter *et al,* 1987). The increased glucose concentrations at parturition (wk 0) may be due to the stress of parturition (Tharwat *et al,* 2012).

The serum concentration of cortisol during the periparturient period is increased significantly at parturition (wk 0). During the late stage of pregnancy, there is an increase in the ACTH section from the foetal pituitary which stimulates the rapid growth of the foetal adrenals, leading to a rise in the concentration of serum cortisol. The increased cortisol enters the maternal circulation and induces parturition by activating the production of prostaglandin F2α (Arthur *et al,* 1989; Suganya *et al,* 2000; Suganya and Gomathy, 2009).

The serum activity of oestrogen increased from wk -2 and reached its maximum peak at parturition (wk 0) and declined thereafter. This increase is also physiological as it is required for uterine contractions during parturition (Khan and Ludri, 2002; Alwan *et al,* 2010). On the other side, the serum activity of progesterone decreased sharply at parturition and thereafter (wk 0 to wk 3). This decline is physiological due to the destruction of the corpus luteum of pregnancy and the decreased level of progesterone released from the placenta (Khan and Ludri, 2002; Alwan *et al,* 2010).

In conclusion, various haematobiochemical changes were observed during the periparturient period in female dromedary camels. Haematological abnormalities included mainly neutrophilia post-partum. Significant biochemical changes were seen in the serum concentrations of globulin, AST, GGT, ALP, glucose, cortisol, oestrogen, and progesterone. These haematobiochemical variables may thus be used as references for she camels during the periparturient period.

References

Alwan AF, Amin FAM and Ibrahim NS (2010). Blood progesterone and oestrogen hormones level during pregnancy and after birth in Iraqi sheep and goat. Basrah Journal of Veterinary Research 10:153.

Arthur GH, Noakes DE and Pearson H (1989). Veterinary Reproduction and Obstetrics, 6th edn, ELBS Publishers, London, UK. pp 133.

Drackley JR (1999). Biology of dairy cows during the transition period: The final frontier. Journal of Dairy Science 82:2259-2273.

El-Ghoul W, Hofmann W, Khamis Y and Hassanein A (2000). Relationship between claw disorders and the peripartal period in dairy cows. Prakt Tierarzt 81:862-868.

Guo J, Peters RR and Kohn RA (2007). Effect of a transition diet on production performance and metabolism in periparturient dairy cows. Journal of Dairy Science 90:5247-58.

Khan JR and Ludri RS (2002). Hormone profile of crossbred goats during the periparturient period. Tropical Animal Health and Production 34:151-162.

Leon JB, Smith BB, Timm KI and LeCren G (1990). Endocrine changes during pregnancy, parturition and the early post-partum period in the llama (*Lama glama*). Journal of Reproduction and Fertility 88:503-511.

Nehra V, Angulo P, Buchman AL and Lindor KD (2001). Nutritional and metabolic considerations in the etiology of nonalcoholic steatohepatitis. Digestive Diseases and Sciences 46:2347-2352.

Overton TR and Waldron MR (2004). Nutritional management of transition dairy cows: Strategies to optimise metabolic health. Journal of Dairy Science 87 (E Suppl.), E105–E119.

Peter AT, Bosu WT, MacWilliams P and Gallagher S (1987). Peripartal changes in serum alkaline phosphatase activity and lactate dehydrogenase activity in dairy cows. Canadian Journal of Veterinary Research 51:521-524.

Radostits OM, Mayhew IG and Houston DM (2000). Veterinary Clinical Examination and Diagnosis. W.B. Saunders, London.

Riveros JL, Urquieta B, Bonacic C, Hoffmann B, Bas F and Schuler G (2009). Endocrine changes during pregnancy, parturition and post-partum in guanacos (*Lama guanicoe*). Animal Reproduction Science 116:318-325.

Rosenberger G (1990). Die Klinische Untersuchung des Rindes. 3rd edn. Berlin and Munich, Paul Parey.

Sghiri A and Driancourt MA (1999). Seasonal effects on fertility and ovarian follicular growth and maturation in camels (*Camelus dromedarius*). Animal Reproduction Science 55:223–37.

SPSS (2009). Statistical Package for Social Sciences. Chicago, IL, USA: SPSS, Inc. Copyright for Windows, version 18.0.

Suganya G and Gomathy VS (2009). Hormone profile of Tellicherry goats during periparturient period. Tamilnadu. Journal of Veterinary and Animal Sciences 5:211-221.

Suganya G, Leela V, Viswanathan S and David BP (2000). Circulating levels of cortisol during pregnancy, parturition and post-partum periods in goats. Indian Veterinary Journal 77:202-204.

Tharwat M, Oikawa S and Buczinski S (2012). Ultrasonographic prediction of hepatic fat content in dairy cows during the transition period. Journal of Veterinary Science and Technology 3:1.