EFFECT OF DIFFERENT GESTATION PERIODS ON SOME PHYSIOLOGICAL ASPECTS OF IRAQI FEMALE DROMEDARY CAMEL (*Camelus dromedarius*)

Y. T. Abdul-Rahaman
Assis. Prof.
College of Veterinary Medicine, University of Fallujah
yassentaha97@yahoo.com

A. A. Mnati
Assis. Prof.
College of Veterinary Medicine, University of Kerbala
amnate@yahoo.com

W. M. Mohammed
Lecturer
College of Veterinary Medicine, University of Fallujah
wissamatea@yahoo.com

ABSTRACT

This study was conducted to investigate the influence of different gestation periods on hematological and biochemical profile of Iraqi female camel. The study was done at the College of Veterinary Medicine, University of Fallujah during the period from August, 1 to July, 11, 2013. The experiment included 12 (6 pregnant and 6 non-pregnant), Iraqi female camels. Blood samples were collected at days 20, 30, 40, 50, 60, 90, 120, 150 and 180 post-mating (PM). The blood samples for hematological, biochemical and plasma minerals assay. ESR and eosinophils were showed no significant different (P≤0.05) during different gestation period. Excluding data for cholesterol, HDL and LDL, all other biochemical parameters in pregnant camels showed higher significant differences (P≤0.05). Calcium, phosphorous, sodium, potassium and magnesium were increased significantly different (P≤0.05) during various gestation period. Non-significant differences were observed between pregnant and non–pregnant females in WBC's, ESR, MCHC and differential leukocytes count, while P.C.V, Hb, RBC's, MCV and MCH exhibited higher significant different (P≤0.05) between different stages. The total protein, albumin, HDL and LDL higher significant different (P≤0.05), all other biochemical parameters between pregnant and non– pregnant were showed non- significant. Phosphorous was the unique mineral showed increased significant different (P≤0.05) between pregnant and non–pregnant female camels. In conclusion, different effects of gestation periods were noticed on some hematological, biochemical parameters as well as plasma minerals of Iraqi female camels.

Keywords: Gestation periods; Physiological aspects; Iraqi Dromedary camel

مجلة العلوم الزراعية العراقية -2018 :49(4):694-707 عبدالرحمن وأخرون

تأثير مدد مختلفة من الحمل على بعض الأوجه الفسلجية في إناث الجمال العراقية ذات السنام الواحد (*Camelus dromedarius*)

ياسين طه عبد الرحمن
أستاذ مساعد
كلية الطب البيطري/ جامعة الفلوجة
yassentaha97@yahoo.com

أحمد عبد الرضا مناتي
أستاذ مساعد
كلية الطب البيطري/ جامعة كربلاء
amnate@yahoo.com

وسام محمود محمد
مدرس
كلية الطب البيطري/ جامعة الفلوجة
wissamatea@yahoo.com

المستخلص

هدفت الدراسة لمعرفة تأثير مدد الحمل المختلفة على المعايير الدمية والكيموحيوية في إناث الجمال العراقية. أجريت الدراسة في كلية الطب البيطري/ جامعة الفلوجة للفترة من 2013/1/8 ولغاية 2013/7/11. تضمنت التجربة 12 حيوان (6 حامل و6 غير حامل) لإناث الجمال العراقية. تم سحب الدم عن طريق الوريد الوداجي للأيام 20، 30، 40، 50، 60، 90، 120،150 و180 بعد التلقيح. تم تحليل عينات الدم للصفات الدميّة والكيمياحيوية وتحليل المعادن في البلازما. سرعة ترسيب الدم والخلايا الحامضية أظهرت عدم وجود اختلافاً معنوياً (P≤0.05) لمستويات مختلفة خلال مدد الحمل المختلفة. وباستبعاد بيانات الكوليسترول، البروتين الدهني العالي الكثافة والبروتين الدهني الواطئة الكثافة، كانت جميع المعايير الكيموحيوية الأخرى في الإبل الحوامل عالية المعنوية (P≤0.05). كما كانت الفروق معنوية في كل من الكالسيوم والفوسفور والصوديوم والبوتاسيوم والمغنيسيوم (P≤0.05) خلال مدد الحمل المختلفة. وقد لوحظت فروق غير معنوية بين الإناث الحوامل وغير الحوامل في حجم خلايا الدم البيضاء، سرعة ترسيب الدم، معدل نسبة تركيز الهيموغلوبين في كريات الدم الحمراء والعد الكلي لكريات الدم البيضاء المختلفة، بينما كانت هنالك فروق معنوية في مكداس الدم، نسبة الهيموغلوبين، وحجم كريات الدم الحمراء، الحجم الكروي الوسطي، معدل الهيموغلوبين الكرية الوسطي (P≤0.05) بين مستويات المراحل. باستثناء البروتين الكلي، الألبومين، البروتين الدهني العالي الكثافة والبروتين الدهني الواطئة الكثافة (P≤0.05)، كانت جميع المعايير الكيموحيوية الأخرى بين الحوامل وغير الحوامل غير معنوية. الفوسفور كان المعدن الوحيد الذي أظهر فروق عالية المعنوية (P≤0.05) للمستويات بين الإناث الحوامل وغير الحوامل. نستنتج وجود تأثيرات مختلفة لمدد الحمل على المعايير الدمية والكيموحيوية في الدم وكذلك معادن البلازما لإبل الإناث العراقية.

الكلمات المفتاحية: مدد الحمل، الأوجه الفسلجية، الجمال العراقية ذات السنام الواحد.

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INTRODUCTION

Camels are sexually mature when they are reaches four or five years old. After gestation for 12 to15 months, females give birth to a single calf weighing (45). Camels (*Camelus dromedarius*) play an important role in the economy and social life of a large sector in arid and semi-arid regions in several localities in the world (47). Pregnancy is one of the physiological conditions that leads to significant changes in hematological and biochemical parameters of all animal species (8). Hematological and biochemical blood parameters are of great importance to the veterinary practitioner as they provide valuable information that can contribute to the assessment of the health status of the animal and the monitoring of prognosis in pathological disorders (12). There are several including age, nutrition, stress, temperature, gestation, muscle activity, and disease have an effects on blood parameters (36, 41). Hematological parameters are helpful to determine the health and nutritional status of animals (25). The implication of determining hematological parameters of domestic animals is well- documented (44). Knowledge of the specific changes taking place during pregnancy is very important in clinical practice because all metabolic functions are increased during pregnancy to satisfy the demands of the fetus, the placenta, and the uterus. Increase in metabolic functions during pregnancy results in alteration of the biochemical profile (1, 51). The detailed information pertaining to the hematological and biochemical parameters of Iraqi female dromedary camels and their relation with pregnancy status were not previously investigated. Therefore, the aim of the present study was to assess the effect of different gestation periods on hematological, blood biochemical and plasma minerals attributes for Iraqi one-humped female camels (*Camelus dromedarius*).

MATERIALS AND METHODS

This study was conduced at the Animal Farm, College of Veterinary Medicine, University of Fallujah during the period from August, 1 to July, 11, 2013. This experiment included 12 (6 pregnant and 6 non-pregnant), non-lactating Iraqi female camels (*Camelus dromedarius*) of 7- 8 years old and average body weight of 500-600 kg. Animals were daily fed per head of 4 kg green roughages (alfalfa, barley and sorghum), 10 kg of alfalfa hay and 0.5 kg of barley grains (18). Water and mineral blocks were available *ad libitum*. Camels kept in semi-closed fenced pens with appropriate area for moving easily. Estrus and mating signs were detected for each animal. The pregnancy were diagnosed by ultrasonography and confirmed by rectal palpation. Females were naturally mated with fertile male, by placing females with male in similar pens.

Blood sampling and assay

Blood samples were collected via heparinized vacationer tubes, at days 20, 30, 40, 50, 60, 90, 120, 150 and 180 post-mating (PM). The plasma were harvested following centrifugation of the samples (3000 RPM for 15 minutes) and stored under -20°C until assay. The assay was undertaken at Al-Nazil Clinical Laboratory, Fallujah, Anbar. The blood samples were assessed for hematological parameters which includes. Packed cell volume (PCV) by microhematocrit, hemoglobin (Hb) by acid hematin (Sahli's haemoglobinometer) method. White blood cells (WBC's) and red blood cells (RBC's) were counted according to Hawakey and Dunnett (26). Erythorcyte sedimentation rate (ESR) was determined by Westeregen Sedimentation tubes. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were calculated using the formula reported by Jain (28). Differential leukocytes count (DLC) (%) were estimated in thin May-Grunwald-Giemsa stained blood smears (33). Biochemical parameters were also estimated includes; total proteins (22), albumin (14) were involved. Globulin was calculated by taking the difference between total protein and albumin. Urea (61), creatinine (27), Alanine Aminotransferase Activity (ALT), Aspartate Aminotransferase Activity (AST) (49). Cholesterol (5) concentrations were quantitatively determined using the kit provided by Agappe Diagnostice Company, Switzerland, Triglycerides (55) and High density lipoproteins (HDL) (38). The kit was provided by Biomerieux Company, France. Low density lipoproteins (LDL) was calculated by equation= cholesterol- HDL+

vLDL, and Very low density lipoproteins (VLDL) was calculated by dividing the Triglycerides by 5 (17). The concentrations of some minerals (calcium, phosphorous, sodium, potassium and magnesium) were analyzed by spectrophotometrically, APLI. The kit was provided by SPINREACT,S.A./S.A.U. Ctra.Santa Coloma, 7 E-17176 SANT ESTEVE DE BAS (GI) SPAIN.

Statistical analyses

Statistical analysis were performed using General Linear Model (GLM) procedure in the SAS program (52) to examine the influence of gestation periods on blood hematological, biochemical and some minerals parameters. The statistical model for analysis of variance (ANOVA) was:

$Yij = \mu + Pi + eij$

Where:

Yij = dependent variable (PCV, Hb, WBC's, RBC's, ESR, MCV, MCH, MCHC, neutrophil, lymphocyte, monocyte, eosinophils, basophil, total protein, albumin, globulin, urea, creatinine, ALT, AST, cholesterol, triglycerides, HDL, LDL, vLDL, calcium, phosphorous, sodium, potassium and magnesium)

μ = overall mean.

Pi = effect of gestation period (P = Days 20, 30, 40, 50, 60, 90, 120, 150 and 180 PM for P CV, Hb, WBC's, RBC's, ESR, MCV, MCH, MCHC, neutrophil, lymphocyte, monocyte, eosinophils, basophil, total protein, albumin, globulin, urea, creatinine, ALT, AST, cholesterol, triglycerides, HDL, LDL, VLDL, calcium, phosphorous, sodium, potassium and magnesium).

eij = error term

Differences among means were compared using the Duncan multiple range test (15).

RESULTS AND DISCUSSION

Hematological parameters in pregnant Iraqi female dromedary camels during different gestation periods are shows in Table.1: The results of packed cell volume (PCV) in the female camels during different gestation periods showed significant difference ($p \leq 0.05$). It is higher at days 30 (30.83±1.58%), 40 (30.16±1.95%), 50 (31.33±1.11%), 60 (30.16±1.32%) and decreased at the days 150 (26.33±1.60%) and 180 (26.16±1.11%) PM (Table 1). Significant differences ($P \leq 0.05$) were noticed in hemoglobin over the study periods. Increased hemoglobin count ($P \leq 0.05$) was observed at days 30 (13.83±0.66 g/dl) and 50 (13.96±0.57 g/dl) PM, however, it tended to be lesser at day 180 (11.80±0.49 g/dl) PM (Table 1). Red blood cells (RBC's) showed increase in number ($P \leq 0.05$) at day 30 PM (7.50±0.48 $\times 10^6/mm^3$) and significantly decrease at days 150 (6.00±0.35 $\times 10^6/mm^3$) and 180 (5.88±0.29 $\times 10^6/mm^3$) PM (Table 1). The PCV, Hb and RBCs were higher in the early days of pregnancy and lower in the remaining days as there is a direct correlation between these parameters. The decrease in concentration might be due to the mobilization of mother's haemoglobin to foetal circulation, and also due to the dilution of blood which occurs as a consequence of increasing plasma volume that is present in that period, causing a slight anemia (58). The hemodilution mechanism is of particular importance in animals as it enables increased oxygen and nutrient supply to the fetus by decreasing blood flow in the capillaries and increasing the blood flow in the placental capillaries (48). The effects of different gestation periods on ESR of the female camels were non-significant. MCV and MCH showed significant difference ($P \leq 0.05$) the studied periods. It was lesser at day 20 (40.01±0.18 Fl and 18.03±0.17 pg respectively), and significantly ($P \leq 0.05$) increased during 60 (44.68±1.2 Fl and 19.84±0.66 pg respectively), 120 (44.46±1.04 Fl and 20.26±0.54 pg respectively), 150 (43.98±0.89 Fl and 20.01±0.39 pg respectively) and 180 (44.60±0.93 Fl and 20.13±0.41 pg respectively) days PM (Table 1). The MCHC were showed significant ($P \leq 0.05$) increase during days 120 (45.54±0.23 %) and 150 (45.51±0.07 %) PM and decreased at day 60 (44.37±0.31 %) of pregnancy (Table 1). MCV, MCH and MCHC increased significantly with advancement of gestation period. The increase observed in MCV MCH and MCHC could be related to the increase demand of oxygen transport capacity of the blood resulting from decreased RBC count (57). The highest ($P \leq 0.05$) count of WBCs was recorded during days 50 (12.00±0.75

$\times 10^3/mm^3$), and the lowest at 150 (8.10±0.44 $\times 10^3/mm^3$) PM. A trend of increased neutrophil during days 40 (55.50±1.61 %) and 50 (55.50±1.87%) PM, and significantly decrease at days 90 (50.00±1.52%) and 180 (51.00±1.86%) PM (Table 1). Moreover, high percentage of lymphocyte ($p \leq 0.05$) was observed at days 90 (40.50±1.66%), 150 (40.83±1.91%) and 180 (40.50±1.95%), While low in days 40 (35.83±1.70%) and 50 (35.66±2.01) PM (Table 1). The percentage of monocyte was higher ($p \leq 0.05$) at day 20 (2.00±0.37%), and decreased at day 90 (1.16±0.17%)PM. Non-significant differences in eosinophils through days of the gestation were showed. Basophils were significantly ($p \leq 0.05$) increased at day 90 (0.50±0.22 %) and lower at days 30, 60, 150 and 180 (0.00±0.00%) PM (Table 1). White blood cell count is increased in pregnancy with the lower limit of the reference range being typically 6.000/ cumm(19). Leucocytosis, occurring during pregnancy is due to the physiologic stress induced by the pregnant state (19). Neutrophils are the major type of leucocytes on differential counts (20, 37). This is likely due to impaired neutrophilic apoptosis in pregnancy (20). The neutrophil cytoplasm shows toxic granulation. Neutrophil chemotaxis and phagocytic activity are depressed, especially due to inhibitory factors present in the serum of a pregnant female (29). There is also evidence of increased oxidative metabolism in neutrophils during pregnancy. Immature forms as myelocytes and metamyelocytes may be found in the peripheral blood film of healthy female during pregnancy and do not have any pathological significance (32). They simply indicate adequate bone marrow response to an increased drive for erythropoesis occurring during pregnancy. Lymphocyte count decreases during pregnancy through the first and second trimesters and increases during the third trimester. There is an absolute monocytosis during pregnancy, especially in the first trimester, but decreases as gestation advances. Monocytes help in preventing fetal allograft rejection by infiltrating the decidual tissue (7^{th}– 20^{th} week of gestation) possibly, through PGE2 mediated immunosuppression (35). The monocyte to lymphocyte ratio is markedly increased in pregnancy. Eosinophil and basophil counts, however, do not change significantly during pregnancy (16). The stress of parturition may itself lead to brisk leucocytosis. Few hours after birth, healthy female have been documented as having a WBC count varying from 9.000 to 25.000/cumm. By 4 weeks post-delivery, typical WBC ranges are similar to those in healthy non-pregnant female (30).

Blood biochemical parameters in pregnant Iraqi female dromedary camels during different gestation periods are showed in Table.2:

Significant differences were noticed in plasma total protein concentration over the study periods. Higher ($P \leq 0.05$) concentrations were observed at day 180 PM (6.63±0.09 g/dl), and lesser at days 90 and 150 (5.85±0.11 and 5.91±0.08 g/dl respectively. Plasma albumin was significantly increased ($P \leq 0.05$) at day 120 (4.63±0.04 g/dl) as compared with the other periods. The concentrations at days 20, 30, 40, 150 and 180 were 4.10±0.09, 4.20±0.11, 4.21±0.04, 4.16±0.26 and 4.14±0.14 g/dl respectively (Table 2). Plasma globulin was significantly greater ($P \leq 0.05$) at day 180 (2.49±0.23 g/dl), and lesser at days 90 and 120 PM (1.41±0.09, 1.46±0.08 g/dl respectively; Table 2). During heavy pregnancy, there is abundant synthesis of proteins in the liver, and this is as a result of the higher energy requirement for fetal growth. Glucocorticoids improve the mobilization of extra hepatic proteins and transport amino acids to liver cells. The mobilized amino acids in liver cells are utilized during gluconeogenesis, which is the primers source of energy for the fetus (54). The observed constancy in the total protein, albumin and globulin, could probably as a consequent of them being required by the fetus for bone and other tissues formations. The cell membranes are generally permeable to metabolites or non-protein nitrogen (39) The observed increase in the intracellular concentrations of metabolites (10), could be due to the shift from the plasma to the erythrocyte by such small molecules (3). Similarly, plasma urea concentration tended to be higher at day 150 (67.30±1.57 mg/dl), and significantly ($P \leq 0.05$) reduced at days 20, 30 and 120 PM (Table 2). Plasma creatinine

concentration was significantly lesser (P≤0.05) at day 120 PM (1.20±0.09 mg/dl) and greater (p≤0.05) at day 150 (2.00±0.05 mg/dl) PM (Table 2). Elevated urea and creatinine concentration is an important indicator of the increased glomerular filtration rate (GFR) which increases especially in late gestation due to the increased total blood volume (31, 46). The creatinine level (marker of kidney function) is dependent on the dietary intake, synthesis rate of creatinine. Therefore, the high creatinine levels in animals during gestation could a result of higher protein needs and this is associated with late stage of pregnancy due to the lower rate of kidney elimination (45). From another point of view, the camels can conserve and recycle urea for microbial protein synthesis in the fore stomach to avoid the negative protein balance that occurs (as in the other farm animals) during heat stress, since the kidneys of the camel not only excrete small amounts of urine but the animal can also produce urine with extremely low concentration of urea (56). The urea formed during protein metabolism in the camel is not necessarily excreted, but it may pass back into the fore stomach from the blood plasma via the saliva and through the rumen wall. In addition, camel kidneys can conserve and correct negative mineral balance occurred when heat stressed (40). The effects of different gestation periods of on ALT activity of the female camels were significant (P≤0.05). It was lesser at day 20 (15.81±0.42 U/L) and 30 (15.72±0.83 U/L) PM, and increased significantly (P≤0.05) at day 180 (23.91±0.40 U/L) PM (Table 2). The AST activity was decreased at days 20, 30, 40, 50 and 60, and significantly lesser (P≤0.05) at day 180 (27.92±0.97 U/L) PM (Table 2). The increased intracellular levels of ALT and AST during pregnancy are disagreed with its value in the plasma (6). These alterations could have been a product of accelerated erythropoietic activity since young blood cells are characterized by increased activities of enzymes (53). Otherwise, it could be attributed to the intracellular dehydration induced by increased extracellular fluid Na+ concentration (3). There are no significant effects of different gestation periods on cholesterol, HDL and LDL concentrations (Table 2). The highest triglycerides and vLDL levels were recorded during 50 (47.43±5.82 and 47.33±3.17 mg/dl respectively) and 90 days (9.48±1.16 and 9.46±0.63 mg/dl respectively) PM and decreased at day 180 PM (28.66±3.55 mg/dl and 5.73±0.71 mg/dl respectively; Table 2), Triglycerides are the storage form of lipids and provide an energy source not only to the animal's body but also to the ovum during its maturation within the Graafian follicle. The camel is a draft animal and has the ability to restore its energy longer time than many other animal species (4). Physiological status is also associated with a strong reduction in lipogenesis during the pregnancy and lactation periods (43, 63). All through pregnancy and lactation periods the number of total insulin receptors (TIR) decreases and insulin stimulation of lipogenesis becomes in-efficient (11, 24). The increasing profile observed in triglycerides and vLDL levels at day 50 and 90 PM and decreased at day 180 PM could be related to the excessive intake of glucose to maintain body reserves for the supply of fetal energy requirements (7).

Plasma minerals concentrations in pregnant Iraqi female dromedary camels during different gestation periods are showed in Table.3: Calcium concentrations was significantly (p≤0.05) higher at days 90 (9.74±0.13 mmol/l) and 120 days (9.79±0.09 mmol/l) and lower at day 180 (9.02±0.17 mmol/l) PM. The mean phosphorous concentration was reduced at day 30 (4.79±0.20 mmol/l) PM. The level increased significantly (P≤0.05) at day 150 PM (6.70±0.75 mmol/l; Table 3). The highest sodium concentration was reported at day 60 PM (183.66±8.46 mmol/l) and decreased at days 20 (156.83±7.31 mmol/l) and 30 PM (159.33±5.96 mmol/l). Higher (P≤0.05) concentration of potassium was observed at days 180 PM (5.17±0.22 mmol/l), and value was observed at day 40 PM (3.66±0.21 mmol/l; Table 3). Significant differences were observed in magnesium concentration over the study, its higher (P≤0.05) value was at day 50 PM (2.04±0.08 mmol/l) and tended to be lower at day 180 PM (1.41±0.07 mmol/l; Table 3). Macro- and micro-electrolytes are necessary for animal functioning and health (2). The parathyroid hormone, calcitonin, and

cholecalciferol are involved in the hemostasis of blood calcium and phosphorous concentrations. These hormones also have an effect on Mg metabolism (60). The findings suggested strong possibility that calcium is being withdrawn from the dam and transferred to the foetus. Calcium is crucial in bone nominalization and for basic physiological processes such as blood coagulation particularly required for fetal growth during the late stage of pregnancy(42). The significant increase in intracellular sodium during the gestation period is comparable to the uniformly observed hypernatraemia during late pregnancy (30, 34, 50). This late pregnancy-induced hypernatraemia may have resulted from the particularly high aldosterone production, which promotes Potassium excretion and Sodium reabsorption in the renal tubule, during pregnancy (50) The increased extracellular fluid sodium will cause water to pass out of the cells which could result in intracellular dehydration (39) and associated with increasing intracellular potassium concentrations (3). Magnesium is an indispensable element for all living cells; its deficiency is marked with decalcification of the skeleton (9). The variation in plasma magnesium concentrations during the gestation period might be due to the property of magnesium to remain increased in the cells. The mechanism by which magnesium is controlled is not understood, and aldosterone is known to increase its renal excretion (64).

Hematological parameters in pregnant and non-pregnant Iraqi female dromedary camels are showed in Table.4:

The effects of pregnancy status on PCV, Hb, RBCs, MCV and MCH were significant (P≤0.05), being higher in pregnant than non-pregnant female camels. The red blood cell indices lowered in pregnancy. However, there is a small increase in mean corpuscular volume (MCV). Increased production of RBCs to meet the demands of pregnancy, reasonably explains why there is an increased MCV (due to a higher proportion of young RBCs which are larger in size). However, MCV does not change significantly during pregnancy and a hemoglobin concentration\ 9.5 g/dL in association with a mean corpuscular volume\ 84 fl probably indicates co-existent iron deficiency or some other pathology (13). Post partum, plasma volume decreases as a result of diuresis, and the blood volume returns to non-pregnant values. Hemoglobin and hematocrit increase consequently. Plasma volume increases again two to five days later, possibly because of a rise in aldosterone secretion. Later, it again decreases. Significant elevation has been documented between measurements of hemoglobin taken at 6-8 weeks postpartum and those taken at 4-6 months postpartum, indicating that it takes at least 4-6 months post pregnancy, to restore the physiological dip in hemoglobin to the non-pregnant values (59). The WBCs, ESR, MCHC, neutrophil, lymphocyte, monocyte and eosinophils were numerically higher in pregnant than non-pregnant female camels (Table 4).

Blood biochemical parameters in pregnant and non-pregnant Iraqi female dromedary camels are showed in Table.5:

The total protein, albumin and HDL were significantly (P≤0.05) increased in the pregnant group (103.18±3.60 g/dl, 4.28±0.05 g/ dl and (15.05±0.98 mg/dl respectively) as compared with non-pregnant group (5.74±0.08 g/dl, (3.87±0.06 g/dl and 12.26±0.68 mg/dl respectively). In contrast, greater (P≤0.05) LDL (13.29±1.49 mg/ dl) were observed in non-pregnant than in pregnant (9.52±0.62 mg/ dl) female camels. Other biochemical parameters did not significantly different between pregnant and non-pregnant female camels (Table 5). All enzymes and many hormones that regulate biochemical reactions are functional proteins (62). Total protein contents can be fractionated into albumin and globulin. The slight increase in total protein and albumin concentrations in late pregnancy, is as a result of hormonal changes in the organism. The interpretation of variations in liver and serum enzyme activities is complicated because the activity is affected by changes in the levels of cofactors, activators and inhibitors, as well as by changes in the concentration of the enzyme itself. ALT and AST activities showed significant correlation with serum albumin, corresponding to the higher activity of the liver along with natural mechanisms, which combat oxidative stress

during heavy pregnancy (45). Moreover, Lipoproteins are macromolecular complexes of proteins, phospholipids, cholesterol, cholesterol ester and triglycerides and function to transport lipids through blood. The HDL and LDL play an important role in the transport of cholesterol within the body (23).

Plasma minerals concentration in pregnant and non-pregnant Iraqi female dromedary camels are showed in Table.6: There are no significant effect of pregnancy status on calcium, sodium, potassium and magnesium (Table 6). Phosphorus was significantly ($P \leq 0.05$) greater in pregnant (5.62±0.13 mmol/l) than non-pregnant (5.15±0.12 mmol/l) female camels (Table 6). Phosphorus is an important macro-element in animal's body (21). All synthetic acid processes connected with growth and production involves phosphoric acid compounds (4). Phosphorous is known to be involved in high energy bonds that link oxides of phosphate to carbon or to carbon nitrogen compounds (such as adenosine triphosphate, ATP). Phosphorus is also intimately involved in acid-base buffer systems of blood and other body fluids (64). In conclusion, obvious effects of different gestation periods were investigated on hematological, blood biochemical parameters as well as minerals concentration of Iraqi female dromedary camels, that is the first time investigated in Iraq. However, the influence of pregnant state on these attributes was lesser.

Table 1. Hematological parameters in pregnant Iraqi female dromedary camels during different gestation periods (Mean ± SE).

Parameters	Gestation period (days)									Level of Significance
	20	30	40	50	60	90	120	150	180	
P.C.V (%)	29.66±1.17 ab	30.83±1.58 a	30.16±1.95 a	31.33±1.11 a	30.16±1.32 a	29.83±1.02 ab	28.83±1.11 ab	26.33±1.60 b	26.16±1.11 b	*
Hb (g/dl)	13.35±0.42 abc	13.83±0.66 a	13.50±0.54 ab	13.96±0.57 a	13.38±0.47 abc	13.49±0.64 ab	13.12±0.49 abc	11.98±0.72 bc	11.80±0.49 c	*
RBC's ($\times10^6$/mm^3)	7.41±0.29 ab	7.50±0.48 a	6.99±0.30 ab	7.23±0.24 ab	6.78±0.31 abc	6.81±0.28 abc	6.52±0.37 bc	6.00±0.35 c	5.88±0.29 c	*
ESR (mm/1 hr)	6.33±1.02 a	6.00±1.15 a	5.33±0.76 a	5.16±0.65 a	5.66±0.61 a	5.66±0.42 a	5.00±0.58 a	6.33±0.88 a	6.66±0.84 a	NS
MCV (Fl)	40.01±0.18 c	41.28±0.98 bc	43.19±1.23 ab	43.23±0.84 ab	44.68±1.21 a	43.76±0.55 ab	44.46±1.04 a	43.98±0.89 a	44.60±0.93 a	*
MCH (pg)	18.03±0.17 c	18.54±0.52 bc	19.34±0.53 ab	19.29±0.38 abc	19.84±0.66 a	19.78±0.27 ab	20.26±0.54 a	20.01±0.39 a	20.13±0.41 a	*
MCHC (%)	45.07±0.39 abc	44.90±0.22 abc	44.79±0.20 abc	44.63±0.48 b	44.37±0.31 c	45.21±0.29 ab	45.54±0.23 a	45.51±0.07 a	45.14±0.21 abc	*
WBC's ($\times10^3$/mm^3)	11.36±0.80 abc	11.80±0.79 ab	10.53±0.46 abc	12.00±0.75 a	9.83±0.52 cd	10.03±0.85 bc	10.30±0.53 abc	8.10±0.44 d	9.70±0.54 c	*
Neutrophil (%)	52.66±2.06 ab	54.33±1.28 ab	55.50±1.61 a	55.50±1.87 a	51.50±1.93 ab	50.00±1.52 b	52.66±1.84 ab	51.33±1.88 ab	51.00±1.86 b	*
Lymphocyte (%)	38.66±1.58 ab	37.00±0.68 ab	35.83±1.70 b	35.66±2.01 b	39.33±2.51 ab	40.50±1.66 a	38.50±0.67 ab	40.83±1.91 a	40.50±1.95 a	*
Monocyte (%)	2.00±0.37 a	1.66±0.21 ab	1.83±0.17 ab	1.83±0.40 ab	1.50±0.22 ab	1.16±0.17 b	1.66±0.21 ab	1.50±0.22 ab	1.83±0.31 ab	*
Eosinophil (%)	6.33±0.71 a	7.00±0.68 a	6.66±0.61 a	6.83±0.54 a	7.66±0.71 a	7.83±1.11 a	7.00±0.63 a	6.33±0.42 a	6.00±0.26 a	NS
Basophil (%)	0.33±0.21 ab	0.00±0.00 b	0.16±0.16 ab	0.16±0.16 ab	0.00±0.00 b	0.50±0.22 a	0.16±0.16 ab	0.00±0.00 b	0.00±0.00 b	*

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05, NS= Non-significant

Table 2. Blood biochemical parameters in pregnant Iraqi female dromedary camels during different gestation periods (Mean ± SE).

Parameters	Gestation period (days)									Level of Significance
	20	30	40	50	60	90	120	150	180	
Total Protein (g/dl)	6.16±0.24 bc	6.41±0.11 ab	6.26±0.07 b	6.08±0.13 bc	6.21±0.07 bc	5.85±0.11 c	6.09±0.10 bc	5.91±0.08 c	6.63±0.09 a	*
Albumin (g/dl)	4.10±0.09 b	4.20±0.11 b	4.21±0.04 b	4.39±0.09 ab	4.31±0.09 ab	4.43±0.05 ab	4.63±0.04 a	4.16±0.26 b	4.14±0.14 b	*
Globulin (g/dl)	2.06±0.17 bc	2.20±0.13 ab	2.05±0.09 bc	1.68±0.11 cd	1.90±0.10 bc	1.41±0.09 d	1.46±0.08 d	1.75±0.24 c	2.49±0.23 a	*
Urea (mg/dl)	46.36±1.43 c	42.78±1.21 c	52.31±3.55 bc	47.56±3.61 bc	50.86±6.86 bc	49.93±3.93 bc	44.45±2.35 c	67.30±1.57 a	57.21±3.56 b	*
Creatinine (mg/dl)	1.35±0.09 bc	1.33±0.05 bc	1.45±0.11 bc	1.34±0.12 bc	1.29±0.21 bc	1.37±0.12 bc	1.20±0.09 c	2.00±0.05 a	1.56±0.11 b	*
ALT (U/L)	15.81±0.42 e	15.72±0.83 e	17.36±0.85 de	17.24±0.52 de	18.45±0.44 d	20.08±0.17 c	22.49±0.87 ab	21.50±0.29 b	23.91±0.40 a	*
AST (U/L)	17.37±0.41 c	16.32±0.51 c	16.67±0.27 c	16.36±0.32 c	16.01±0.25 c	21.09±0.29 b	22.80±1.25 b	22.63±0.94 b	27.92±0.97 a	*
Cholesterol (mg/dl)	31.27±4.18 a	28.16±3.40 a	29.33±3.03 a	34.16±2.24 a	34.66±7.17 a	34.00±3.07 a	36.83±5.87 a	35.00±4.49 a	29.00±3.09 a	NS
Triglycerides (mg/dl)	39.16±6.81 abc	32.34±3.98 bc	33.74±3.94 abc	47.43±5.82 a	40.93±7.81 abc	47.33±3.17 a	46.00±4.39 ab	40.50±5.17 abc	28.66±3.55 c	*
HDL (mg/dl)	15.40±3.95 a	10.68±2.47 a	12.07±1.76 a	14.38±1.51 a	18.04±4.56 a	14.87±2.13 a	18.20±4.08 a	16.92±3.23 a	14.88±1.79 a	NS
LDL (mg/dl)	8.03±1.52 a	11.01±1.61 a	10.51±1.44 a	10.29±2.43 a	8.44±3.18 a	9.65±1.93 a	9.42±1.93 a	9.98±1.63 a	8.38±1.54 a	NS
VLDL (mg/dl)	7.83±1.36 abc	6.46±0.79 bc	6.74±0.78 abc	9.48±1.16 a	8.18±1.56 abc	9.46±0.63 a	9.20±0.88 ab	8.10±1.03 abc	5.73±0.71 c	*

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05, NS= Non-significant

Table 3. Plasma minerals concentrations in pregnant Iraqi female dromedary camels during different gestation periods (Mean ± SE).

Concentrations	Gestation period (days)									Level of significance
	20	30	40	50	60	90	120	150	180	
Calcium (mmol/l)	9.26±0.09 bc	9.52±0.19 ab	9.28±0.14 bc	9.18±0.16 bc	9.34±0.14 bc	9.74±0.13 a	9.79±0.09 a	9.54±0.04 ab	9.02±0.17 c	*
Phosphorous (mmol/l)	5.11±0.17 cd	4.79±0.20 d	5.14±0.16 bcd	5.42±0.22 cd	6.27±0.31 ab	6.03±0.45 abc	5.62±0.29 bc	6.70±0.75 a	5.49±0.33 bcd	*
Sodium (mmol/l)	156.83±7.31 d	159.33±5.96 d	161.83±4.60 cd	168.16±7.66 abcd	183.66±8.46 a	169.83±2.91 abc	167.16±3.49 bc	176.66±4.49 abc	179.16±2.65 ab	*
Potassium (mmol/l)	4.42±0.06 ab	4.24±0.30 ab	3.66±0.21 b	4.04±0.13 b	4.09±0.05 b	4.52±0.52 ab	3.67±0.56 b	3.97±0.61 b	5.17±0.22 a	*
Magnesium (mmol/l)	1.88±0.05 ab	1.87±0.07 ab	1.99±0.04 ab	2.04±0.08 a	2.01±0.07 ab	2.02±0.15 ab	1.82±0.14 ab	1.77±0.09 b	1.41±0.07 c	*

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05

Table 4. Hematological parameters in pregnant and non-pregnant Iraqi female dromedary camels (Mean ± SE)

Parameters	Pregnancy status		Level of significance
	pregnant	non-pregnant	
P.C.V (%)	29.25±0.47 a	25.90±0.60 b	*
Hb (g/dl)	13.16±0.19 a	11.69±0.28 b	*
WBC's ($\times10^3/mm^3$)	10.40±253.95 a	8.78±301.97 a	NS
RBC's ($\times10^6/mm^3$)	6.79±0.13 a	6.14±0.16 b	*
ESR (mm/1 hr)	5.79±0.26 a	7.25±0.38 b	NS
MCV (Fl)	43.23±0.35 a	42.30±0.32 b	*
MCH (pg)	19.47±0.17 a	19.11±0.16 b	*
MCHC (%)	45.02±0.10 a	45.17±0.18 a	NS
Neutrophil (%)	52.72±0.54 a	51.98±0.75 a	NS
Lymphocyte (%)	38.53±0.56 a	39.38±0.67 a	NS
Monocyte (%)	1.66± 0.09 a	1.62± 0.08 a	NS
Eosinophil (%)	6.85±0.22 a	6.92±0.19 a	NS
Basophil (%)	0.14±0.05 a	0.11±0.04 a	NS

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05, NS= Non-significant.

Table 5. Blood biochemical parameters in pregnant and non-pregnant Iraqi female dromedary camels (Mean ± SE)

Parameters	Pregnancy status		Levels of significance
	pregnant	non-pregnant	
Total Protein (g/dl)	6.18±0.05 a	5.74±0.08 b	*
Albumin (g/dl)	4.28±0.05 a	3.87±0.06 b	*
Globulin (g/dl)	1.89±0.06 a	1.87±0.07 a	NS
Urea (mg/dl)	50.97±1.45 a	50.79±1.52 a	NS
Creatinine (mg/dl)	1.43±0.04 a	1.41±0.04 a	NS
ALT (U/L)	19.17±0.42 a	18.30±0.36 a	NS
AST (U/L)	19.68±0.57 a	19.17±0.49 a	NS
Cholesterol (mg/dl)	32.49±1.38 a	32.89±1.69 a	NS
Triglycerides (mg/dl)	39.57±1.38 a	36.69±1.33 a	NS
HDL (mg/dl)	15.05±0.98 a	12.26±0.68 b	*
LDL (mg/dl)	9.52±0.62 b	13.29±1.49 a	*
VLDL (mg/dl)	7.91±0.36 a	7.33±0.27 a	NS

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05, NS= Non-significant

Table 6. Plasma minerals concentration in pregnant and non-pregnant Iraqi female dromedary camels (Mean ± SE)

Concentrations	Pregnancy status		Levels of significance
	pregnant	non-pregnant	
Calcium (mmol/l)	9.41±0.05 a	9.35±0.07 a	NS
Phosphorous (mmol/l)	5.62±0.13 a	5.15±0.12 b	*
Sodium (mmol/l)	169.18± 2.10 a	170.95± 2.54 a	NS
Potassium (mmol/l)	4.20±0.13 a	4.32±0.19 a	NS
Magnesium (mmol/l)	1.87±0.03 a	1.88±0.04 a	NS

Means with different superscripts within each row differ significantly (P≤0.05). * = P≤0.05, NS= Non-significant

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