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## The acute effects of dexamethasone on some haematological parameters and serum biochemistry in the camel (*Camelus dromedarius*)

WASFI (I. A.), GADIR (F. A.), ABDULLA (O. M.). Les effets aigus de la dexaméthasone sur quelques paramètres sanguins et sur la biochimie sérologique du dromadaire. *Revue Elev. Méd. vét. Pays trop.*, 1989, 42 (4) : 479-483.

Les effets de la dexaméthasone, administrée à différentes doses, sur quelques paramètres sanguins et sur la biochimie sérologique ont été étudiés chez le dromadaire. La dexaméthasone augmente la concentration de glucose dans le sérum, de même que les neutrophiles et la numération leucocytaire totale dans le sang. A l'inverse, les concentrations de potassium et de phosphore dans le sérum et la numération des lymphocytes dans le sang ont baissé sous l'effet du même traitement. Aucun changement n'a été constaté sur l'activité des CPK et des  $\gamma$ -GT, sur les concentrations sérologiques de créatinine, de BUN, de bilirubine totale, de cholestérol et de sodium ni sur les valeurs de PCV, Hb, ESR, MCV et MCHC. *Mots clés* : Dromadaire - *Camelus dromedarius* - Dexaméthasone - Sang - Sérologie - Emirats Arabes Unis.

### INTRODUCTION

Corticosteroids are widely used in veterinary medicine. Their effects are numerous and widespread. They influence carbohydrate, protein, fat and purine metabolism; electrolyte and water balance; and the functions of the cardiovascular system, the kidney, skeletal muscle, the nervous system and other organs and tissues (6, 12). In addition, the corticosteroids endow the organism with the capacity to resist many types of environmental changes. The mechanism of action of the corticosteroids at the molecular level is well established (10). There are some studies on the effects of corticosteroids in domestic animals. For example GOETSCH *et al.* (5) observed a minor Na retention but a profound blood glucose elevation in cows treated with 9- $\alpha$ -fluo-roprédnisolone. Using the same corticosteroid in cows, NEFF *et al.* (9) observed an increase in blood concentration and a decrease in the serum concentrations of Na, K and P. It has been reported that glucocorticoid therapy resulted in decreased milk

production in ketotic cows (3, 9) but not in well fed healthy cows (11). Such reports are however absent in camels.

In United Arab Emirates, camel racing is widely practiced. Many ailments in race camels necessitate the administration of a corticosteroid. The following study was therefore planned to study the acute effects of a pharmacological dose of dexamethasone, a synthetic corticosteroid, in healthy mature male camels.

### MATERIALS AND METHODS

#### Animals

Three clinically healthy male camels 4-6 years old were used. They were drenched with ivermectin for internal parasites. The animals are allowed rhodes grass and water *ad lib*. The animals were left for eight days prior to dexamethasone(\*) treatment for acclimatization. During this period blood was collected at reasonable intervals.

Animal number 1 received one injection of dexamethasone (20 mg) intravenously. Animal number 2 received a daily 1/m injection of dexamethasone (20 mg) for four days. Animal number 3 received a daily 1/V injection of dexamethasone (24 mg) for four days.

Blood was collected at 8.00 a.m. in a heparinized and a plain vacutainer from each animal 4 h after injection and daily for 12 days.

Blood was allowed to clot, serum was separated after centrifugation at 2,000 g for 10 minutes, and stored at -20 °C. It was analysed within two days.

#### Haematological methods

The packed cell volume (PCV) was measured by a microhaematocrit centrifuge, hemoglobin (Hb) concentration was determined by the cyanmethemoglobin technique. Red and white blood cells (RBC and WBC) were counted with a Coulter instrument model

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(\*) Dexamethasone sodium phosphate (Alvetra, West Germany) 4 mg/ml.

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ZS. Mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) were calculated from the RBC, PCV, and Hb values.

Differential leukocyte count was done by the battlement method (Schalm, 1965). Erythrocyte sedimentation rate (ESR) was measured by the Westergren method.

### Chemical methods

The activities of total creatinine kinase (CK) and  $\gamma$ -glutamyl transferase ( $\gamma$ -GT) in serum were measured at 37 °C by Aca IV autoanalyzer (Dupont, USA). The concentrations of creatinine, blood urea nitrogen (BUN), total protein (TP), and phosphorus (P) in serum were measured by Aca IV autoanalyzer. Sodium (Na) and Potassium (K) concentrations in serum were measured by ion selective electrodes (Orion 1020 Na/K analyser USA). The concentrations of total bilirubin (TB), cholesterol and glucose in serum were measured by a reflectance photometer (seralyzer, Ames, USA). Chemical analysis was performed after proper calibration and quality control testing of the instruments as suggested by manufacturer.

### RESULTS

Under these experimental conditions, dexamethasone produced pronounced effects on only glucose, K, P, neutrophils, lymphocytes and total WBC. No effects of dexamethasone were observed on the activities of CPK and  $\gamma$ -GT on the concentrations of creatinine, BUN, TB, cholesterol and Na and on PCV, Hb, ESR, RBC, MCV and MCHC values (data not shown). Figure 1 shows the effect of a single intravenous injection of 20 mg dexamethasone in camel No. 1. As early as 4 h post-injection, glucose concentration, neutrophils and total leukocyte counts increased to high levels. The maximum levels were observed by the 2nd day after injection. On the other hand, the concentrations of potassium and phosphorus and lymphocytes count were decreased by dexamethasone administration. However pronounced reductions of these elements were observed one day after treatment. The lowest levels of K and P were observed by the first and 3rd day respectively after dexamethasone treatment. The concentrations of glucose, K, P and the total WBC returned to pretreatment values by the 5th day post-treatment. Neutrophils and lymphocyte counts, however, returned to pretreatment levels by the 8th day after treatment.

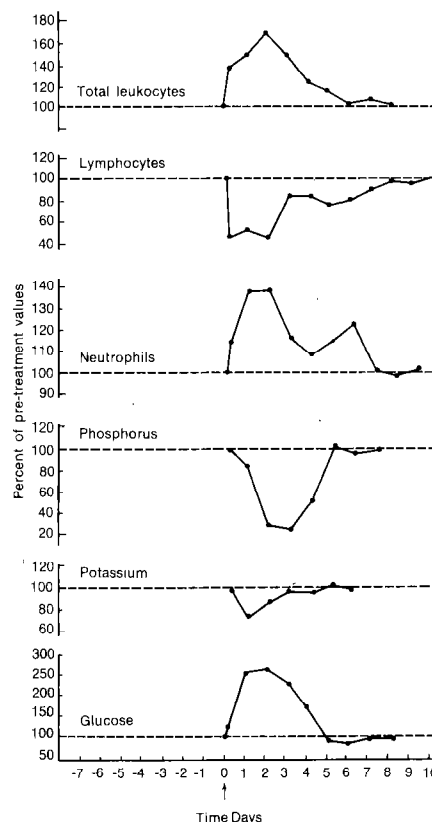


Fig. 1 : The effect of a single intravenous injection of dexamethasone (20 mg) on glucose, potassium, phosphorus, neutrophils, lymphocytes and total leukocytes on camel No. 1.

Figure 2 shows the effects of a daily 1/m injection of 20 mg dexamethasone for 4 days in camel No. 2. Changes similar to a single 1/V injection dexamethasone also occurred with repeated 1/m injections, viz ; the concentration of glucose, the counts of neutrophils and total WBC increased while the serum concentrations of K, P and the lymphocytes count decreased. Maximum effects were observed by the 2nd and 3rd day post-treatment. Return to pretreatment values was observed by the 8th day onwards.

Figure 3 shows the effects of daily 1/V injection of 24 mg dexamethasone for 4 days in camel No. 3. As with the other dose regimens, the concentration of glucose and the count of neutrophils and total WBC increased while the concentrations of K, P and the count of lymphocytes decreased. Return to pretreatment levels was on the 6th day for glucose, on the 7th day for P, on the 8th day for K, lymphocyte and total WBC counts and on the 10th day for neutrophils. The difference between the dose regimens was quantitative ; the net effect was larger with repeated injections and it took a longer time to return to pretreatment levels.

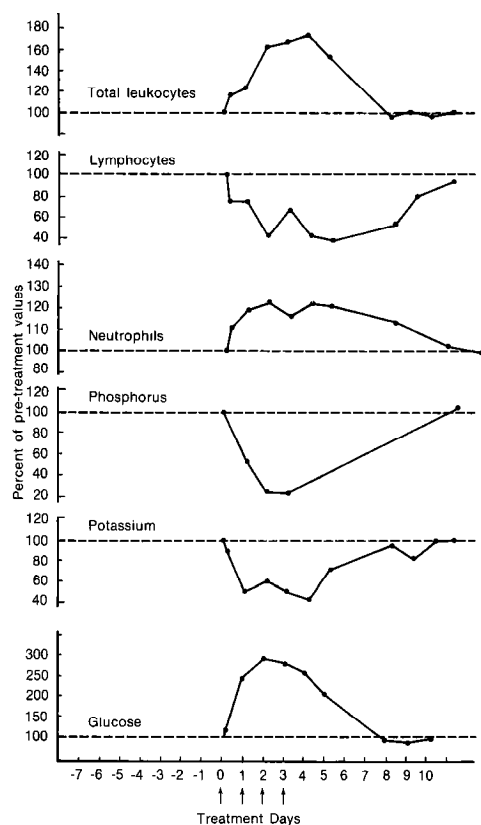


Fig. 2 : The effect of a daily intramuscular injection of dexamethasone (20 mg) for four days on glucose, potassium, neutrophils, lymphocytes and total leukocytes on camel No. 2.

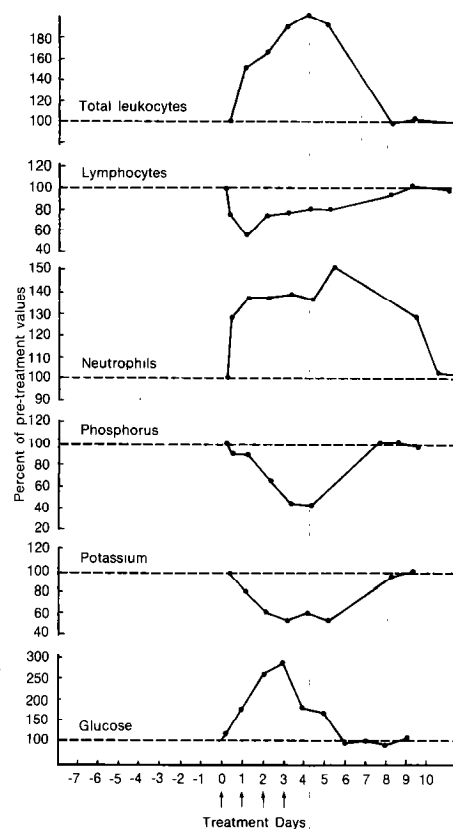


Fig. 3 : The effect of a daily intravenous injection of dexamethasone (24 mg) for four days on glucose, potassium, neutrophils, lymphocytes and total leukocytes on camel No. 3.

## DISCUSSION

The objectives of this study was to evaluate the acute effects of dexamethasone, by different dose regimens, on some serum metabolites, serum minerals and haematological parameters in the camel. Under these experimental conditions dexamethasone resulted in increased concentration of glucose in serum. Elevated blood glucose concentration could be the result of increased formation and/or decreased utilization. However, if dexamethasone elevated glucose concentration through enzyme induction, this would require a longer time and cannot account for the early increase of glucose concentration. Glucocorticosteroids are known to stimulate the formation of glucose, diminish its peripheral utilization and promote its storage as glycogen. The mechanism by which the glucocorticosteroids inhibit utilization of glucose in peripheral tissues is not understood. However, decreased uptake of glucose has been demonstrated in

adipose tissue, skin, fibroblasts and thymocytes as a result of glucocorticoid action. In addition, glucocorticosteroids increase the formation of glucose by promoting gluconeogenesis by both peripheral and hepatic tissues (1, 8), peripherally these steroids act to mobilize amino acids from a number of tissues like lymphatic tissues, muscle and bone. Amino acids then funnel into the liver where they serve as substrates for enzymes involved in the production of glucose and glycogen (1). In the liver glucocorticoids increase the concentration of the enzymes involved in the process of gluconeogenesis, namely phosphoenolpyruvate carboxykinase, fructose 1-6- diphosphatase and glucose-6- phosphatase (1). NEFF *et al.*, (9) using 9- $\alpha$ -fluprednisolone in dairy cows in doses of 50 and 100 mg 1/m observed increased concentrations of glucose in the serum. The highest values in their study were attained about 40 h post-treatment. However our percent increases from pretreatment levels were higher than what was reported by NEFF *et al.* (9). This could be attributed to species differences and/or to the fact that dexamethasone has a stronger gluconeogenic effect than does 9- $\alpha$ -fluprednisolone (7).

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Mineralocorticoids are known to act on the distal tubules of the kidney to enhance the reabsorption of Na ions from the tubular fluid into plasma and to increase the urinary excretion of both K and H ions. In this experiment, dexamethasone resulted in severe hypokalemia possibly as a result of increased secretion of K in urine and it seems to be dose dependent. Dexamethasone is said to have a very weak Na retaining activity. Although no increase was observed in Na ions in serum, a positive Na balance and expansion of the extracellular fluid, with the exception of the blood volume, cannot be excluded from this study. Clearly, expansion of blood volume has not occurred under these experimental conditions. This is evidenced by unchanged PCV and many metabolites before and after dexamethasone treatment. For this reason the mechanism by which dexamethasone has enhanced K excretion cannot be visualized as an exchange of Na since the latter concentration did not increase in serum. Clearly more work is needed in this area to evaluate among other things urine electrolytes and measurements of body fluids. NEFF *et al.* (9) observed somewhat similar effects on K by the use of 50 and 100 mg 9- $\alpha$ -fluoprednisolone on dairy cows. Hypokalemia, irrespective of the mechanism by which it has developed, has grave consequences on the performance of the cardiovascular and skeletal systems. A withdrawal time of at least 10 days is therefore recommended for such drugs in animals intended for racing.

A pronounced reduction in serum P was observed. Similar findings were reported by NEFF *et al.* (9). This is possibly the result of increased P excretion in urine. Dexamethasone produced in the camel changes in the formed elements of blood similar to those reported in other species. Thus increased counts of WBC and neutrophils and a decreased count of lymphocytes were observed. It should be noted however that the

absolute count of lymphocytes was either normal or greater than normal when compared to pretreatment values. This is due to an increased absolute number of total WBC. In man it has been reported that a single dose of cortisol produced a decline of about 70 per cent in circulating lymphocytes. The decline being more on T lymphocytes than on B lymphocytes (4). In man, unlike laboratory animals, the lymphopenia is a result of redistribution rather than of destruction of cells (4). No evidence of lymphocyte destruction was observed in dexamethasone treated camels. A dramatic increase was observed in both the relative and absolute number of neutrophils in dexamethasone treated camels. BISHOP *et al.* (2) related this phenomenon to the combination of an increased rate of entrance of polymorphonuclear leukocytes into the blood from the bone marrow and a diminished rate of their removal.

The lack of effect of dexamethasone on some parameters, which are known to be affected by glucocorticosteroids might be attributed to the acute nature of the experiment. However a species difference cannot be ruled out completely.

It might be concluded that short term administration of dexamethasone in the camel, a synthetic corticosteroid, produced changes similar to those reported in other species.

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The effects of dexamethasone at different dose regimens on some haematological parameters and serum biochemistry were studied in the camel. Dexamethasone increased the serum concentration of glucose as well as neutrophils and total leukocyte count in the blood. Conversely, the serum concentrations of potassium and phosphorus and lymphocyte count in blood were decreased by dexamethasone treatment. Dexamethasone, however, had no effect on the activities of CPK and  $\gamma$ -GT, on the serum concentrations of creatinine, BUN, total bilirubin, cholesterol and Na and on PCV, Hb, ESR, MCV and MCHC values. *Key words* : Camel - *Camelus dromedarius* - Dexamethasone - Blood - Serology - United Arab Emirates.

WASFI (I. A.), GADIR (F. A.), ABDULLA (O. M.). Los efectos agudos de la dexametasona sobre algunos parámetros hematológicos y sobre la bioquímica serológica del dromedario. *Revue Élev. Méd. vét. Pays trop.*, 1989, 42 (4) : 479-483.

Se estudiaron los efectos de la dexametasona administrada a varias dosis sobre algunos parámetros de la sangre y sobre la bioquímica serológica en el dromedario. La dexametasona aumenta la concentración de la glucosa en el suero así como los neutrofilos y el recuento total de leucocitos en la sangre. Al contrario, las concentraciones de potasio y de fósforo en el suero y el recuento de los linfocitos en la sangre disminuyeron bajo el efecto del mismo tratamieto. No se constató ningún efecto sobre la actividad de los CPK y de los  $\gamma$ -GT, sobre las concentraciones serológicas de creatinina, de BUN, de bilirubina total, de colesterol y de sodio ni sobre los valores de PCV, Hb, ESR, MCV y MCHC. *Palabras calves* : Dromedario - *Camelus dromedarius* - Dexametasona - Sangre - Serologia - Emiratos Arabes Unidos.

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