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## Serum protein electrophoretic pattern in one-humped camels (*Camelus dromedarius*) in Tripoli, Libya

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### Abstract

The aim of this study was to characterize serum protein capillary electrophoretic pattern in apparently healthy adult male (age: 3-7 years) dromedary camels and also evaluate total protein and albumin levels using automated analyzer. Blood samples were taken from 20 camels. 5ml of blood was collected from the jugular vein and serum was separated from samples by centrifugation. Capillary electrophoresis of serum proteins identified six protein fractions in adult camels, including albumin, alpha1, alpha2, beta1, beta2 and gamma globulins, serum levels of these parameters were 3.9±0.04 g/dl, 0.16±0.01 g/dl, 0.39±0.03 g/dl, 0.515±0.03 g/dl, 0.205±0.01 g/dl and 0.61±0.04 g/dl, and 65.42±0.62 g/l, respectively. The total protein concentration was 65.42±0.62 g/L, while, the albumin/globulin (A/G) ratio was 2.4±0.14. The present study indicates six peaks with minicapillary electrophoresis and the results obtained were compared and interpreted in the light of finding reported by other investigators in camels.

**Keywords:** Camels, Electrophoresis, Proteins, Serum.

### Introduction

Camels represent an important sector in the livestock in Libya. They are mainly valuable for their milk and meat production. The total number of camels in Libya is 62125 (FAO, 2016). For a long time, camel is a neglected animal in terms of science and research (Wernery and Kaaden, 1995). Hematological and biochemical analysis of blood often provides valuable information for diagnosis and surveillance of general health (Nyang'ao *et al.*, 1997).

The blood serum is composed of hundreds of different proteins, and concentrations of total proteins and several specific proteins are of clinical value (Joliff, 1992). Protein electrophoresis is a standard technique to separate and determine the protein components in plasma or serum in clinical biochemistry. Analysis of serum proteins by electrophoresis resolved 6 bands, comprising albumin, alpha1, alpha2, beta1, beta2 and gamma globulins (Vaden *et al.*, 2009).

The variability in the concentration of serum proteins has significant challenges in understanding different diseases. Chaudhary *et al.* (2003) have reported that serum protein electrophoresis on agarose gel in camels produced six peaks comprising one albumin,  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ ,  $\beta_2$  and  $\gamma$ -globulin fractions. However, Others (Elkhair and Hartmann, 2014) have reported that serum electrophoresis pattern of the camel using capillary electrophoresis showed five peaks, one albumin,  $\alpha_1$ ,

$\alpha_2$ ,  $\beta$  and  $\gamma$ -globulins fractions and is influenced by age. The sources of these variations are likely due to genetic, environmental or sensitivity of the techniques.

This study was carried out to determine the normal electrophoretic pattern, total serum proteins and albumin of different serum proteins of blood collected from apparently healthy adult male dromedary camels (*Camelus dromedarius*).

### Materials and Methods

#### Animals and blood sample collection

Twenty adult (3-7 years old) healthy male camels where chosen for the study from a herd with good management and feeds, the herd located in the suburban area of Tripoli, Libya.

Five ml of blood was collected from jugular vein of each camel into silicon-coated vacuum containers for biochemical studies. Serum was separated by centrifugation at 3000 RPM for 10 minutes and stored at 2-8 degrees Celsius until further analysis after five days.

#### Laboratory methods

Albumin and total protein were analyzed on autoanalyzer Cobas c 311 (Roche/Hitachi cobas C systems).

Serum proteins were analyzed in Sebia minicapillary (Sebia, France). The Sebia system uses the principle of capillary electrophoresis in free solution, and charged molecules are separated by their electrophoretic

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mobility at a specific pH in an alkaline buffer separation, each sample is diluted in a dilution buffer and the capillaries are filled with the separation buffer, samples are then injected by aspiration into the anodic end of the capillary.

A high voltage protein separation is then done; direct detection and quantification of the different protein fractions is performed at a specific wavelength at the cathode end of the capillary (Landers, 1995; Gay-Bellile *et al.*, 2003; Sam and Larry, 2006; Tariq *et al.*, 2016).

The capillary instrument enables the separation of serum protein into six major fractions (albumin, alpha1, alpha2, beta1, beta2, and gamma) and calculate the albumin : globulin ratio (A/G ratio).

#### Statistical Analysis

The means (x) and standard errors of the mean (SEM) were calculated using descriptive statistical procedures with SPSS for Windows version 11.0 (SPSS, Chicago, USA).

#### Results and Discussion

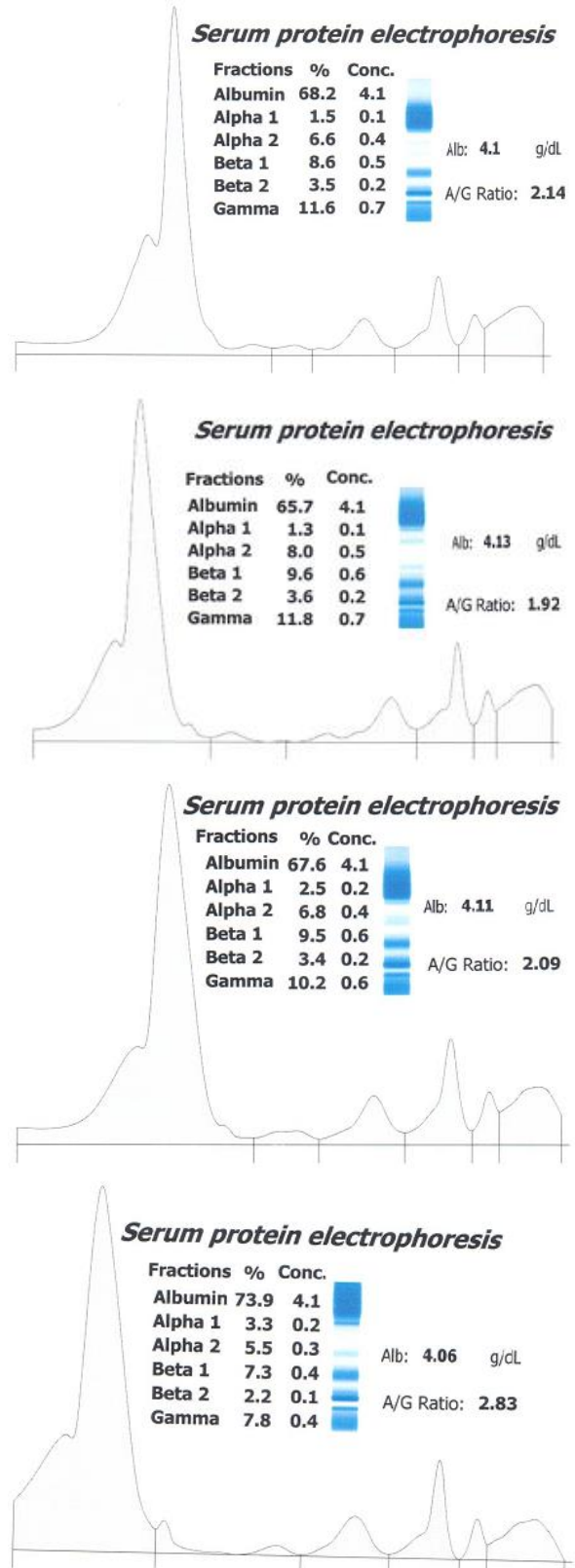
Sebia minicapillary electrophoresis of serum protein revealed six fractions: albumin, two alpha globulins (alpha1 and alpha2) two beta globulins (beta1 and beta2) and gamma globulins fractions in adult male camels. The percentage and concentrations of six fractions of proteins and A/G ratio are shown in Fig. 1. The protein fractions, Total protein and Albumin levels are presented in Tables 1 and 2.

The mean±SEM values of various serum protein fractions, Total protein and Albumin will be discussed in relation to other findings reported in camels.

The serum proteins have been studied intensively in many animal species (Osbaldiston, 1972; Keay and Doxey, 1982), yet little work has been done to study the serum protein electrophoresis of camels. The current study focused on biochemical analysis of serum proteins that provides valuable information for diagnosis of some diseases.

At birth, both albumin and globulin are generally low following ingestion of colostrum, globulin concentration increase because of absorption of immunoglobulin, besides that, serum protein levels reported often to decrease during pregnancy and lactation (Jain, 1993). Albumin and globulin production increases as the animal mature and reaches adulthood (Jain, 1993).

Total protein is generally higher in old animals because of slight decreases in albumin (Kaneko, 1989) and increases in alpha and gamma globulins (Batamuzi *et al.*, 1996). Because the proteins of an individual or a species are synthesized under genetic control, it is to be expected that variations in proteins would occur between individuals and between species (Keay and Doxey, 1982).



**Fig. 1.** Percentage and concentrations of six fractions of proteins and A/G ratio.

**Table 1.** Serum percentages (mean±SEM) and concentrations (g/dl) of total protein fractions in apparently healthy male (n=20) adult camels.

Protein fractions	(Mean±SEM) %	Range	Concentration (g/dl)	Range
Albumin	68.11±1.30	3.4 - 4.1	3.9±0.04	3.4 - 4.1
Alpha1	2.3±0.19	0.1 - 0.2	0.16±0.01	0.1 - 0.2
Alpha2	6.84±0.44	0.0 - 0.5	0.39±0.03	0 - 0.5
Beta1	8.79±0.43	0.2 - 0.8	0.52±0.03	0.2 - 0.8
Beta2	3.5±0.25	0.1 - 0.3	0.21±0.01	0.1 - 0.3
Gamma	10.44±0.63	0.3 - 1.1	0.61±0.04	0.3 - 1.1

**Table 2.** Serum concentrations (mean±SEM) of total protein and A/G ratio in apparently healthy males (n=20) of adult camels .

Parameter	Mean±SEM	Range
Total protein (g/L)	65.42±0.62	59.59 - 70.29
Albumin (g/dL)	3.89±0.038	3.43 - 4.13
A/G ratio	2.24±0.14	1.36 - 3.52

Inflammatory disorders have significant effects on plasma protein, protein uptake from plasma increases during tissue repair from injury, and tissue inflammation causes increased vascular permeability, leakage of protein (primarily albumin) into the extravascular space (Kaneko, 1989). With both stress and inflammation there was increased production of an assortment globulin that migrates in the  $\alpha$  and  $\beta$  fractions as part of the acute phase response (Harvey and West, 1987; Eckersall, 1995)

Decrease serum protein may also occur in those patients whose nutritional requirements are not met as a results of malabsorption or maldigestion syndrome (Werner *et al.*, 1994). The concentration of total serum proteins (mean 65.42±0.62, range 59.59-70.29) recorded in this study is in agreement with earlier report (Higgins and Kock, 1986; Wernery *et al.*, 1986; Chaudhary *et al.*, 2003; AL-Busadah, 2007).

Electrophoresis of serum samples produced six peaks comprising albumin, alpha1, alpha2, beta1, beta2 and gamma globulins. The results of the present study performed on mature camels when compared with previous studies (Chaudhary *et al.*, 2003; Al-Sultan, 2008) where a significance difference between adult and young camels reported, this difference may be due to physiological factor because the concentration of total proteins and albumin increases with age due to progressive increase in globulins.

In this study validated the use of sebia minicapillary electrophoresis technique for fractionation of serum proteins in dromedary camels. The minicapillary electrophoresis illustrates six peaks comprising one albumin, alpha1, alpha2, beta1, beta2 and gamma globulins and is in accordance with the results reported by Chaudhary *et al.* (2003) which reported that serum

protein electrophoresis on agarose gel in camels produce six peaks, but in contrast with Elkhair and Hartmann (2014) and Ahmadi-Hamedani *et al.* (2014). This difference can be attributed to the method used for electrophoresis.

The reference range of serum total proteins obtained in the present study for adult camels is comparable to the values reported previously (Abdalla *et al.*, 1988; Mohamed and Hussein, 1999; Elkhair and Hartmann, 2014). However, the range obtained in the current study is lower than that reported by Bogin (2000). The current data indicate that albumin (68.11±1.3%) represent the main fraction of serum proteins determined by minicapillary electrophoresis. The globulin fractions of alpha1, alpha2, beta1, beta2 and gamma represented 2.3±0.19, 6.84±0.44, 8.79±0.43, 3.5±0.23 and 10.44±0.63 respectively (Table 1). These finding are in accordance with Elkhair and Hartmann (2014) and Ahmadi-Hamedani *et al.* (2014), but higher than the values reported for young and adult camels (Chaudhary *et al.*, 2003).

In the present study, the A/G ratio range was 1.36 - 3.52 (mean 2.24±0.14). This result is in agreement with the results of Ahmadi-Hamedani *et al.* (2014) recorded in adult camels, but wider than previous reports published by others (KHadjeh, 1998; Chaudhary *et al.*, 2003; Patodkar *et al.*, 2010; Elkhair and Hartmann, 2014).

### Conclusion

Serum protein electrophoresis and determination of absolute values of serum protein fractions may be useful diagnostic tool. Yet little work has been done to study the serum proteins in Libyan camels. The present study use fully automated analyzer to determined total proteins and albumin. Capillary electrophoresis identified six peaks of protein fractions and A/G ratio in adult male dromedary camels in Libya. This result is in agreement with previous reports published and need more extensive studies.

### Conflict of interest

The authors declare that there is no conflict of interests.

### References

- Abdalla, O.M., Wasfi, I.A. and Gadir, F.A. 1988. The Arabian race camel normal parameters--I. Haemogram, enzymes and minerals. *Comp. Biochem. Physiol. A Comp. Physiol.* 90, 237-239.
- Ahmadi-Hamedani, M., Ghazvinian, K., Kokhaei, P., Barati, M. and Mahdavi, A. 2014. Comparison of effects of age and sex on serum protein electrophoretic pattern in one-humped camels (*Camelus dromedarius*) in Semnan, Iran. *Open Vet. J.* 4, 4-8.
- AL-Busadah, K.A. 2007. Some biochemical and Hematological indices in different breeds of camels in Saudi Arabia. *Sci. J. King Faisal University (Basic Appl. Sci.)* 8, 131-142.

- Al-Sultan, S.I. 2008. Studies of haematological and certain serum biochemical values in young magaheim Dromedary camels at Al-Ahsa province. *Vet. Res.* 2, 34-37.
- Batamuzi, E.K., Kristensen, E. and Jensen, A.L. 1996. Serum protein electrophoresis: potential test for use in geriatric companion animal health programmes. *Zentralbl. Veterinarmed. A.* 43, 501-508.
- Bogin, E. 2000. Clinical pathology of Camelides: Present and future. *Revue. Med. Vet.* 151, 563-568.
- Chaudhary, Z.I., Iqbal, J. and Rashid, J. 2003. Serum protein electrophoretic pattern in young and adult camels. *Aust. Vet. J.* 81, 625-626.
- Eckersall, P.D. 1995. Acute phase proteins as markers of inflammatory lesions. *Comp. Haematol. Int.* 5, 93-97.
- Elkhair, N.M. and Hartmann, H. 2014. Serum protein capillary electrophoretic pattern in camels (*Camelus dromedarius*): Influence of age and sex. *J. Life Sci.* 8, 78-81.
- FAO. 2016. The Food and Agriculture Organization statistical database: <http://www.fao.org/faostat/en/#data/QA>.
- Gay-Bellile, C.D., Bengoufa, P., Houze, D., Le Carrer, M., Benlakehal, B., Bousquet, B., Gourmel, B. and Le Bricon, T. 2003. Automated multicapillary electrophoresis for analysis of human serum proteins. *Clin. Chem.* 49, 1909-1915.
- Harvey, J.W. and West, C.L. 1987. Prednisone-induced increases in serum alpha-2-globulin and haptoglobin concentrations in dogs. *Vet. Pathol.* 24, 90-92.
- Higgins, A.J. and Kock, R.A. 1986. A guide to the clinical examination. Chemical restraint and medication of the camel. Bailliere Tindall, London.
- Jain, N.C. 1993. Essentials of Veterinary hematology. Lea and Febier, Philadelphia.
- Joliff, C.R. 1992. Analysis of the plasma proteins. *J. Clin. Immunoassay* 15, 151-161.
- Kaneko, J.J. 1989. Clinical biochemistry of domestic animals. 4<sup>th</sup> ed. Academic press, San Diego.
- Keay, G. and Doxey, D.L. 1982. Species Characteristics of Serum Proteins Demonstrated after Agarose Gel Electrophoresis. *Vet. Res. Commun.* 5, 263-270.
- KHadjeh, G.H. 1998. Electrophoretic pattern of serum proteins in the Iranian one-humped camel (*Camelus dromedarius*). *Indian J. Anim. Sci.* 68(5), 476-477.
- Landers, J.P. 1995. Clinical capillary electrophoresis. *Clin. Chem.* 41, 495-509.
- Mohamed, H.A. and Hussein, A.N. 1999. Studies on normal haematological and serum biochemical values of the 'Hijin' racing camels (*Camelus dromedarius*) in Kuwait. *Vet. Res. Commun.* 23, 241-248.
- Nyang'ao, J.M.N., Olaho-Mukani, W. and Maribei, J.M. 1997. A study of some haematological and biochemical parameters of the normal dromedary camel in Kenya. *J. Camel Pract. Res.* 4, 380-384.
- Osbaldiston, G.W. 1972. Serum protein fractions in domestic animals. *Br. Vet. J.* 128, 386-393.
- Patodkar, V.R., Somkuwar, A.P., Parekar, S. and Khade, N. 2010. Influence of sex on certain biochemical parameters in nomadic camels (*Camelus dromedaries*) nearby Pune, in Maharashtra. *Vet. World* 3, 115-117.
- Sam, F.Y. and Larry, J.K. 2006. Clinical analysis by microchip capillary electrophoresis. *Clin. Chem.* 52, 37-45.
- Tariq, A., Ijaz, A., Fatima, A., Qurat, U.I., Ansari, U. and Ahmed, A. 2016. Diagnostic accuracy of automated capillary electrophoresis. *Pak. J. Pathol.* 27, 89-93.
- Vaden, S.L., Knoll, J.S., Smith, S.W.K. and Tilley, L.P. 2009. protein electrophoresis in: S.L. Vaden, J.S. Knoll, S.W.K. Smith and L.P. Tilley. Wiley-Blackwell Ames, IA, USA.
- Werner, L.L., Turnwald, G.H. and Barta, O. 1994. Immunologic and plasma protein disorders. In: Willard M.D., Tvedten H., Turnwald G.H., eds. Small animal clinical diagnosis by laboratory methods, 2<sup>nd</sup> ed. Philadelphia, WB Saunders.
- Wernery, U., Murray, E.F. and Wernery, R. 1986. Color atlas of Camelid hematology, Blackwell wissenschafts-Veriag, London.
- Wernery, U. and Kaaden, O.R. 1995. Infectious disease of Camelids. Blackwell wissenschafts-Verlag, Berlin.