

DOI 10.2478/pjvs-2013-0052

Short communication

The serum protein electrophoretic pattern and acute phase protein concentrations in calves with chronic respiratory diseases

Cs. Tóthová, O. Nagy, G. Kováč

Clinic for Ruminants, University of Veterinary Medicine and Pharmacy,
Komenského 73, 041 81 Košice, The Slovak Republic

Abstract

The aim of this study was to evaluate the serum protein electrophoretic pattern and the concentrations of acute phase proteins (haptoglobin, serum amyloid A, and fibrinogen) in 28 calves with clinical signs of chronic respiratory diseases and 36 healthy calves as a control group. In sick calves we found significantly higher serum concentrations of total proteins ($P < 0.001$), lower concentrations of albumin ($P < 0.001$) and marked shift in the concentrations of the most of protein fractions with significantly higher values of α_1 -, β_1 -, β_2 -, and γ -globulins ($P < 0.001$ and $P < 0.01$). The affected calves had significantly higher values of haptoglobin, serum amyloid A, and fibrinogen as well ($P < 0.05$, $P < 0.001$ and $P < 0.001$, respectively).

Key words: calves, electrophoresis, respiratory diseases, protein fractions

Introduction

In veterinary medicine many reports described the serum protein electrophoretic pattern in small animals, goats, and horses (Janků et al. 2011, Tappin et al. 2011). The serum protein electrophoresis and identification of serum protein fractions in cattle with various organ diseases is less well documented. Diagnostically the most important acute phase proteins in cattle are haptoglobin and serum amyloid A. These proteins have been found to increase in the serum of cattle with many different diseases (Gänheim et al. 2003). This study evaluates the effect of chronic respiratory diseases in calves on values of the serum protein electrophoretic pattern and the concentra-

tions of selected acute phase proteins, and their possible usefulness in the assessment of bovine respiratory diseases.

Materials and Methods

28 calves at the age ranged from 4 to 6 months with clinical signs of chronic respiratory diseases were included into this study. At the clinic, the calves were housed individually, fed twice a day with free access to water. After the arrival to the clinic, all the calves were thoroughly examined using standard clinical examination procedures. Into the evaluation we included calves with clinical signs of the disease mani-

Correspondence to: Cs. Tóthová, e-mail: tothova@uvm.sk, tel.: +42 1915 493 082

fed for more than 2 weeks. 36 healthy calves of the same age and breed were used as a control group. Blood samples for the analyses were taken once after the initial clinical examination, when the clinical symptoms of the disease in sick animals were obvious. Blood samples were collected by direct puncture of *vena jugularis* into serum gel separator tubes without anticoagulant. The separated serum was analyzed for the total serum protein concentrations (TP, g/l), serum protein fractions (%), albumin, alpha₁ (α₁)-, alpha₂ (α₂)-, beta₁ (β₁)-, beta₂ (β₂)-, and gamma (γ)-globulins, and acute phase proteins – haptoglobin (Hp, mg/ml) and serum amyloid A (SAA, μg/ml). For the determination of plasma fibrinogen concentrations (Fbg, g/l), blood samples were taken into special tubes with sodium citrate. Albumin:globulin ratios (A/G) were computed from the electrophoretic scan. Total protein concentrations were assessed on automated biochemical analyser Alizé (Lisabio, France) using commercial diagnostic kits (Randox). Serum protein fractions were separated by zone electrophoresis on an automated electrophoresis system Hydrasys (Sebia Corporate, France) using commercial diagnostic kits (Sebia Corporate, France). The concentrations of Hp and SAA were assessed using commercial diagnostic kits (Tridelta Development, Ireland). The determination of Fbg was performed using the semi-automatic coagulometer (Behnk Elektronik, Germany) using commercial diagnostic kits (Diagon Kft, Hungary). Mann-Whitney test was used to evaluate the significance of differences in the results between healthy and sick calves.

Results and Discussion

The total serum protein concentrations in calves suffering from chronic respiratory diseases were significantly higher than the values recorded in healthy animals ($P < 0.001$). Significant differences between the groups of calves were also found for the relative concentrations of albumin ($P < 0.001$), α₂-globulins ($P < 0.05$) and A/G ratio ($P < 0.001$), with lower values in calves with respiratory diseases. An opposite trend was recorded in the relative concentrations of α₁- ($P < 0.05$), β₂- ($P < 0.01$) and γ-globulins ($P < 0.001$). In calves with respiratory diseases we found also significantly higher values for concentrations of Hp ($P < 0.05$), SAA ($P < 0.001$) and Fbg ($P < 0.001$).

In small animal and equine medicine, indications for performing the serum protein electrophoresis have largely centred on the investigation of hyperproteinaemia, hepatic diseases, and screening for gammopathies and immunodeficiencies (Mair et al. 1993, Tappin et al. 2011). However, there are only scarce data regarding the serum protein electrophoretic pattern in cattle with various organ diseases (traumatic gastritis, gastro-phrenitis and traumatic peritonitis) (Yoshida 1986) and there is a lack

of data regarding the serum electrophoretic pattern and changes in albumin and globulin fractions in cattle with respiratory diseases. The present study revealed a significant effect of chronic respiratory diseases in calves on concentrations of the most of serum protein fractions. According to Carapeto et al. (2006), acute inflammatory diseases usually lead to an increase in some of the proteins from the α₁-globulin fraction. Jawor et al. (2008) reported that serious inflammatory conditions are associated with higher concentrations of α-globulins, and that this increase is caused by the fact that the majority of acute phase proteins (haptoglobin, ceruloplasmin, α₁-acid glycoprotein, α₁-antitrypsin) occur in this fraction. Our results suggest that not only acute inflammatory diseases, but also chronic infections may be associated with changes in the globulin fractions, as we found in the calves suffering from chronic respiratory diseases significantly higher concentrations of α₁-, β- and γ-globulins compared to the clinically healthy animals. Moreover, the present study showed in the calves suffering from chronic respiratory diseases markedly higher concentrations of the acute phase proteins which probably influenced also the changes observed in the serum protein electrophoretic pattern in the diseased animals. In conclusion, the present results indicate that chronic respiratory diseases in calves may affect the serum protein electrophoretic pattern with marked shift in the albumin and globulin concentrations, and support the usefulness of acute phase protein measurements in the monitoring of animals with respiratory diseases.

References

- Carapeto MV, Barrera R, Mañe MC, Zaragoza C (2006) Serum α-Globulin Fraction in Horses is Related to Changes in the Acute Phase Proteins. *J Equine Vet Sci* 26: 120-127.
- Gänheim C, Hultén C, Carlsson U, Kindahl H, Niskanen R, Waller KP (2003) The acute phase response in calves experimentally infected with bovine viral diarrhoea virus and/or *Mannheimia haemolytica*. *J Vet Med B Infect Dis Vet Public Health* 50: 183-190.
- Janků L, Pavlata L, Misurova L, Filípek J, Pechova A, Dvorak R (2011) Levels of protein fractions in blood serum of periparturient goats. *Acta Vet Brno* 80: 185-190.
- Jawor P, Steiner S, Stefaniak T, Baumgartner W, Rzasa A (2008) Determination of selected acute phase proteins during the treatment of limb diseases in dairy cows. *Vet Med-Czech* 53: 173-183.
- Mair TS, Cripps PJ, Ricketts SW (1993) Diagnostic and prognostic value of serum protein electrophoresis in horses with chronic diarrhoea. *Equine Vet J* 25: 324-326.
- Tappin SW, Taylor SS, Tasker S, Dodkin SJ, Pappasoulotis K, Murphy KF (2011) Serum protein electrophoresis in 147 dogs. *Vet Rec* 168: 456.
- Yoshida Y (1986) Levels of serum protein, protein fractions and minerals in dairy cow with traumatic gastritis of various conditions. *Nihon Juiqaku Zasshi* 48: 1153-1159.