Rev. Elev. Méd. vét. Pays trop., 1982, 35 (2) : 147-151.

Serum proteins changes in horses infected with surra (*)

par M. A. RAZA (1), ZIA-UR REHMAN (2), A. H. CHAUDHRY, A. H. GILANI, M. NAWAZ

(1) Military Dairy Farm, Okara, Pakistan.
(2) Department of Physiology and Pharmacology, University of Agriculture, Faisalabad, Pakistan.

RÉSUMÉ

Modifications des protéines sériques chez des chevaux atteints de surra

Les échantillons du sérum de 46 chevaux atteints de surra et de 46 chevaux indemnes ont fait l'objet d'une analyse chimique en ce qui concerne les protéines totales et les fractions électrophorétiques.

Les protéines totales des animaux indemnes ne montrent pas de différences significatives par rapport à celles des animaux infectés.

Le taux d'albumine atteint 3,16 g/100 ml chez les chevaux sains alors qu'il est de 1,36 g/100 ml chez les chevaux infectés. L'abaissement du taux d'albumine atteint au moins 80 p. 100 quand on le compare à celui des chevaux en bonne santé. Les résultats indiquent des différences significatives pour les globulines totales et les γ-globulines entre les deux groupes d'animaux mais non pour les α et β globulines. Le rapport albumine/globuline est significativement peu élevé dans le groupe de chevaux infectés.

INTRODUCTION

Surra is a disease, primarily of horses and camels but also affects other animals such as cattle, elephants, sheep, goats, and occasionally dogs. It is caused by a protozoan blood parasite of the class Mastigophora *Trypanosoma evansi,* and is transmitted by biting flies such as *Tabanus. T. evansi* is common in Indo-Pakistan subcontinent and is also wide spread through out the Far East (2).

An important feature of this disease which is exhibited in most cases in oedema, varying from urticarial plaques on the neck and flanks to oedema of the leg and lower parts of the body (13). These manifestations have been ascribed to hypoproteinaemia that results in lowered osmotic pressure of blood and thus the release of plasma in the tissue.

At present, no dependable and convenient parameter is available to assess the magnitude of the infection. Carefully controlled experiments are needed to reveal the specific nature of the alterations taking place in total serum proteins and its fractions in response to the infection. Keeping in view the facts and reasons, the project was planned to study the changes in serum proteins and fractions in horses naturally infected with surra, which would help to explore the pathogenesis and immunological aspects of the disease.

(*) NDLR. Cet article déjà publié dans *Pakistan vet. J.*, 1981, 1 (2) : 78-79 est reproduit dans cette Revue pour accorder une plus large audience aux résultats obtenus.

MATERIALS AND METHODS

Different veterinary hospitals in and around Faisalabad including the veterinary clinic of University of Agriculture, Faisalabad were visited for the collection of samples from the horses suspected for trypanosomiasis (Surra). The disease was confirmed by examining the fresh blood smears for the presence of trypanosomes (13). A total of 46 from healthy and the same number of surra infected horses were subjected to chemical assay for total proteins as well as electrophoretic patterns.

Blood samples from healthy and infected horses were collected from the jugular vein in clean dry centrifugal tube, and were brought to the laboratory for the separation of serum. Serum samples were stored in a deep freezer for further analysis (4).

Total serum proteins was determined by (Bush and Lomb) Refractometer (1, 5). Different fractions of serum proteins were studied by paper Electrophoresis, Beckman Model R. (10).

Student t-test was applied to compare the health and diseased horses. Means, and standard errors were calculated. Analysis of variance technique was applied to see the effect of treatment (14). Correlation and regression values were also calculated.

RESULTS AND DISCUSSION

Serum samples of 46 healthy and the same number of surra infected horses were subjected to chemical assay for total proteins as well as electrophoretic fractions of serum proteins.

The data on total serum proteins and their different fractions have been summarized in table 1. Mean total serum proteins level in healthy animals was 7.94 g/100 ml and it ranged from 7.4 to 9.10 g/100 ml. Apparently mean serum proteins level in surra infected horses was higher than that observed in healthy animals. The increase could be the indication of some damage to the liver. The view was supported by GILMAN (6), who reported a slight rise in the toal serum proteins following experimental infection with equine anemia virus in horse. The differences in total proteins between healthy and infected animals were, however, statistically non-significant ($P < 0.01$). REES and CLARKSON (12) reported that the total protein values of the control and infected sheep with *T. vivax* did not differ significantly. LUCKINS (9) also reported serum proteins concentration in normal and infected cattle and bush buck. He found serum proteins concentration in normal and infected cattle to be some what similar, but infected bush buck had higher serum proteins than in uninfected animals.

TABLE N°I-Average ± SEM of total serum proteins and their different fractions with percentage in normal and surra infected horses

Parameter	Normal (g/100 ml)	Percentage	Infected (g/100 ml)	Percentage
Total Proteins	7.94 ± 0.07 (7.4 - 9.10)	-	8.53 ± 0.09 (7.5 - 9.8)	-
Albumin	3.16 ± 0.07 (1.87 - 3.99)	39.91	1.36** ± 0.05 (0.56 - 2.04)	15.87
Alpha-Globulin	1.19 ± 0.05 (0.61 - 1.99)	14.84	1.12 ± 0.04 (0.6 - 1.5)	13.10
Beta-Globulin	1.53 ± 0.05 (0.87 - 2.50)	19.17	1.37 ± 0.06 (0.39 - 2.17)	16.12
Gamma-Globulin	2.05 ± 0.07 (1.2 - 3.2)	26.04	4.69** ± 0.13 (2.5 - 6.18)	54.58
Total Globulin	4.76 ± 0.08 (3.84 - 5.83)	59.19	7.17** ± 0.11 (5.56 - 8.6)	83.90
A/G ratio	0.68 ± 0.02 (0.33 - 0.99)	0.68	0.19** ± 0.001 (0.1 - 0.36)	0.19

** Significant at 1 per cent level. Values in parenthesis are ranges.

Serum albumin content was found to be 3.16 g/100 ml in healthy horses, and it ranged from 1.87 to 3.99, while it was 1.36 g/100 ml in surra infected animals (Table 1). Student t-test showed significantly ($P < 0.01$) lower albumin value in surra infected horses. In healthy horses, 39.91 per cent of the total proteins was as albumin, whereas it was 15.87 per cent of the total proteins in infected animals. *The decrease in albumin level due to surra was over 80 p. 100 when compared to healthy horses.* Similar results were reported by REES and CLARKSON (12). IKEJIANI (7) also observed a decrease in serum albumin in rats, infected with *T. brucei* or *T. equiperdum* and considered to have been caused by damage to the kidney. This decrease in albumin could be characteristic of trypanosomes (8) and is probably due to immuno complex glomerulonephritis (16) since albuminuremia is a constant feature of trypanosomiasis.

Total globulins was found to be 4.76 g/100 ml in healthy animals, while it was 7.17 g/100 ml in surra infected horses (Table 1). The values for serum proteins obtained from healthy and infected horses were compared using t-test. The results indicated significant ($P < 0.01$) higher total globulins content in infected than normal horses. Gamma-globulin fraction also increased significantly in infected horses while alpha and beta globulin fractions did not differ significantly between normal and infected horses. Although there was a decrease in the alpha and beta fractions of the total globulins, in surra infected horses, this decrease was found to be non-significant ($P < 0.01$) statistically. CLARKSON (3) suggested that increase in gammaglobulin act as a plasma volume expander and that the fall in the concentration of other serum proteins is due to dilution. Almost 100 p. 100 increase was observed in gamma-globulin contents of the infected animals (Table 1). The increase in total globulin content of blood serum of infected horses was mainly due to increase in gamma-globulin fraction (Table 2). This increase is an evidence of the immunogenetic response of surra infected horses. This view is supported by the finding of REES and CLARKSON, who observed almost 2 1/2 time increase of gamma-globulin in infected horses than the control values.

Analysis of variance showed significantly higher values for total globulin and gamma-globulin in infected horses. With the increase of total proteins in surra infected horses, there was an increase of total globulin (Table 2). STEPHEN (15) recorded a rise in gamma-globulin during the course of infected horses with *T. congolense.* It was observed that the gamma-globulin fractions were found to be 40 p. 100 of the total globulins in healthy horses, while it has increased to 60 p. 100 in surra infected horses.

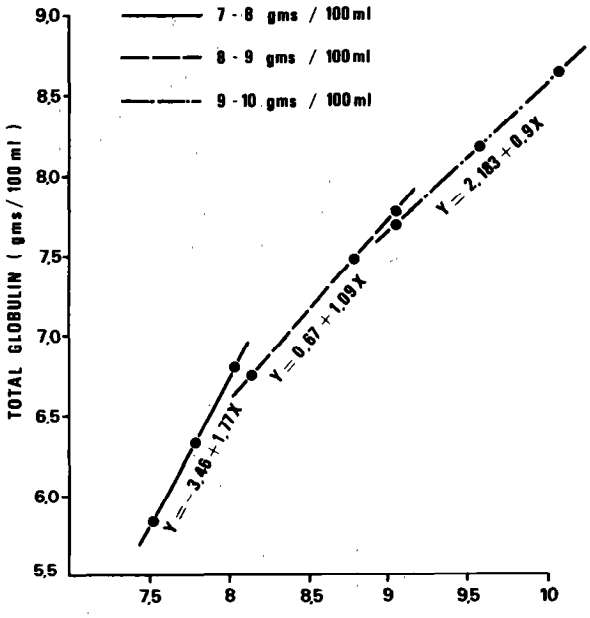
A decrease in the serum albumin level in surra infected horses has probably been made good by an increase in total as well as gamma-globulin levels thus keeping the total serum proteins within normal range.

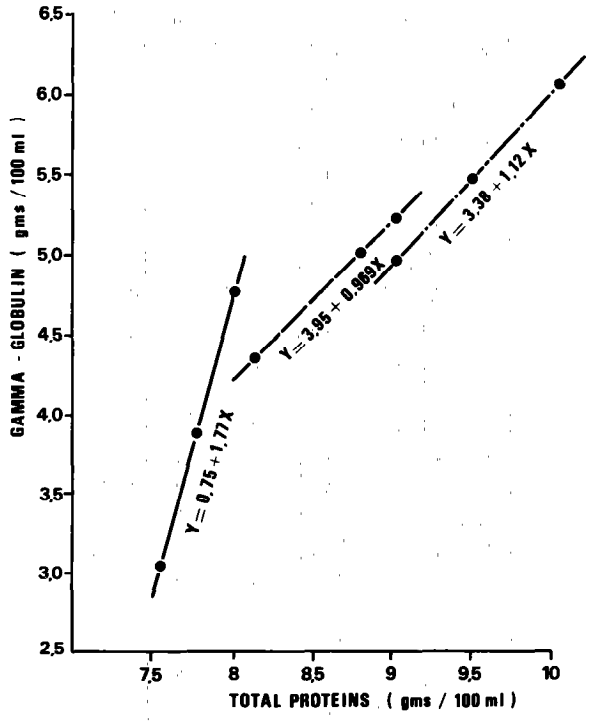
Statistically significant ($P < 0.01$) correlation was observed between different total serum proteins level of infected horses and their total globulin fractions. Regression line were drawn for total globulin and gamma-globulin in three levels of total proteins separately (Fig. 1).

A/G ratio was significantly low in surra infected group. It was found to be 71 per cent less than the healthy horses (Table 1). Since albumin synthesis occurs in liver, as a consequence of most pathological states the albu-

TABLE N°2-Effect of different total serum protein levels on different serum protein fractions of horses infected with surra

Total serum protein levels g/100 ml	N° of animals	Serum proteins g/100 ml				
		Total protein	Albumin	Total globulin	Gamma globulin	A/G ratio
7 - 8	13	7.77 ± 0.19	1.42 ± 0.42	6.35 ± 0.52	3.97 ± 0.99	0.23 ± 0.09
8 - 9	24	8.62 ± 0.30	1.33 ± 0.36	7.29 ± 0.49	4.82 ± 0.67	0.19 ± 0.06
9 - 10	9	9.41 ± 0.30	1.38 ± 0.27	8.93 ± 0.38	5.38 ± 0.58	0.17 ± 0.04





min/globulin ratio falls and occasionally the serum albumin reduction is the primary cause of variation in A/G ratio (11). The increase in gamma-globulin, and decrease in albumin levels of serum in surra infected horses may become a useful measure to evaluate the intensity of pathogenesis during infection.

SUMMARY

Serum sample of 46 healthy and the same number of surra infected horses were subjected to chemical assay for total proteins as well as electrophoretic fractions.

Total proteins from healthy horses did not differ significantly between infected animals. Albumin was found to be 3.16 g/100 ml in healthy whereas it was 1.36 g/100 ml in surra infected animals. The decrease in albumin level due to surra was over 80 p. 100 when compared to healthy horses. The results showed significant differences for total globulin and gamma globulin between healthy and diseased horses, while a non-significant differences were observed for alpha and beta globulins. A/G ratio was significantly low in surra infected group.

RESUMEN

Modificaciones de las proteinas serosas en caballos atacados por el surra *(Trypanosoma evansi)*

Las muestras del suero de 46 caballos atacados por el surra y de 46 caballos indemnes fueron objeto de un análisis químico en lo que concierne las proteinas totales y las fracciones electroforeticas.

Las proteinas totales de los animales indemnes no muestran diferencia significativa con relación a las de los animales infectados.

La dosificación de la albúmina llega a 3,16 g/100 ml en los caballos sanos mientras que es de 1,36 g/100 ml en los caballos infectados.

La disminución de la dosificación de la albumina llega a 80 p. 100 por lo menos cuando se le compara con la de los caballos sanos. Los resultados indican diferencias significativas de las globulinas totales y de las γ-globulinas entre los dos grupos de animales pero no las α y β globulinas.

BIBLIOGRAPHIE

1. ADAMS (H. N.), OSBURU (B. I.). Serum protein in the northern elephant seal. *Am. J. vet. Res.*, 1973, **34** (8) : 1071.
2. BASU (B. C.). Distribution on and personal incidence of surra in India. *Indian J. vet. Sci.*, 1945, **15** : 277-280.
3. CLARKSON (M. J.). Blood and plasma volumes in sheep infected with *Trypanosoma vivax*. *J. comp. Path.*, 1968, **78** : 189-193. *Vet. Bull.*, 1968, **38** (19) : 4028.)
4. Clinical laboratory. 11th ed. of Medico-Chemical Investigation Methods. E. marck Darmatadt, Federal Republic of Germany : P.S.
5. COLES (H. E.). Veterinary clinical pathology. 2nd ed W.B. Saunders Co., 1974 : 208.
6. GILMAN (R. A.). Plasma protein changes in equine infestation anaemia. *Am. J. vet. Res.*, 1952, **13** : 83-89.
7. IKEJIANI (O.). Studies in trypanosomiasis (1). The plasma proteins and sedimentation rates of RBC of rats infected with pathogenic trypanosomes. *J. Parasit.*, 1946, **32** : 369-373.
8. LAUNOY (I.). Albuminurea in experimental *T. evansi* infection in the rabbits. *Bull. Soc. Path. exot.*, 1946, **39** : 159-160. (*Vet. Bull.*, 1947, **17** (4) : 776.)
9. LUCKINS (A. G.). Serum immunoglobin levels and electrophoretic patterns of serum proteins in trypanosome infected bushbuck. *Ann. trop. Med. Parasit.*, 1975, **69** (3) : 337-344. (*Vet. Bull.*, 1975, **45** (12) : 6851.)
10. Modle paper electrophoresis system, Tech. Bull. R.C.-T.B.-001 B. Beckman Instrument Inc., 2500 Harbor Blod., Fullerton, California 1965, 4-8.
11. MULLEN (A. P.). Variations in the albumin content of blood serum in thoroughbred horses. *Equin. vet. J.*, 1970, **2** (3) : 118-120.
12. REES (J. M.), CLARKSON (M. J.). Serum protein in trypanosomiasis of sheep. *Trans. r. Soc. trop. Med. Hyg.*, 1967, **61** : 14 (Sch. Trop. Med. Pembooke Place, Liverpool. 3). (*Vet. Bull.*, 1967, **37** (7) : 2536.)
13. SOULSBY (E. J. L.). Helminthology arthropods and protozoa of domesticated animals. 6th ed. London, E.L.B.S. and Baillere Tindal and Cassell Ltd, 1973 : 552, 792-793.
14. STEEL (R. G. D.), TORRIE (J. H.). Principles and procedures of statistics. New York, Mc Graw Hill Book Company Inc., 1960 : 183-229.
15. STEPHEN (L. E.). Experimental *T. congolense* infection in a horse. *Vet. Rec.*, 1962, **74** : 853-855.
16. VAN DEN INGH (T.), ZWART (A. J. H.), SCHOTMAN (A.), VAN MIERT (A.), VEENENDAAL (C. H.). The pathology and pathogenesis of *Trypanosoma vivax* infection in the goat. *Res. vet. Sci.*, 1976, **21** : 264-270.