Short Communication

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ERYTHROCYTE SEDIMENTATION RATE IN RATS (*RATTUS NORVEGICUS*) NATURALLY INFECTED WITH ENDOPARASITES

Abstract.- A total of 200 brown rats, *Rattus norvegicus,* were examined from Hyderabad and its adjoining areas. The erythrocyte sedimentation rate (ESR) of the rats harboring protozoans *(Trypanosoma lewisi* and *Plasmodium berghei)* in blood, cestodes *(Hymenolepis nana* and *Hymenolepis diminuta)* and nematodes *(Aspicularis pakistanica)* in intestine, bladder worm stages *(Cysticercus fasciolaris)* of *Hydatigera taeniaeformis* (Cestoda) in liver and mixed infection were determined and compared with those of the non-infected rats (Control). Protozoan and mixed infection in male and female rats showed significant rise in ESR value as compared to their control rats of both sexes. Cestode infection caused significant elevation in ESR values of female rats, while male rats did not indicate any change in this parameter. Normal ranges in ESR values were recorded during bladder worm infection in liver of both male and female rats. Significant rise in ESR values was observed in female rats infected with nematodes, whereas male rats showed normal ESR during such infection. It is evident from the present work that the different types of parasitic infections cause sex dependent elevation in ESR values of *Rattus norvegicus* suggesting host-parasite interaction.

Key words: Rats *(Rattus norvegicus),* parasitic infection, ESR.

Erythrocyte Sedimentation Rate is one of the important haematological indices which is commonly used as an indicator to measure the course of infection, severity of disease, chronic inflammation and some types of cancer (Thompson and Proctor, *A short textbook of haematology,* 6th ed. ELBS Churchill Livingstone, UK, 1987; Brigden, *Am. Fam. Physic.*, **60**: 1443-1450, 1999; Koepke *et al., Reference and selected procedure for the erythrocyte sedimentation rate (ESR) test; Approved standard*, 4th ed., NCCLS document H2-A4, 20(27), Wayne, Pennsylvania, USA, 2000; Piva *et al., Clin. Chem. Lab. Med.*, **40**: 713-717, 2002).

Rats are not only the carrier of a number of diseases transmissible to humans but they also act as definitive as well as reservoir hosts for a number of parasitic infections (Cheng, *General parasitology*, 2nd ed. Academic Press, Orlando, Florida, USA, 1986; Faiyaz-ul-Haque *et al., J. Sci.*, **14**: 65-70, 1990; Ghazi *et al., Proc. Parasitol.*, **36**: 69-81, 2003). The importance of rats, therefore, can not be under estimated.

In view of the importance of ESR and rats as carrier of diseases, present study was undertaken to determine the changes in the values of ESR during the different types of parasitic infection in *Rattus norvegicus.*

Materials and methods

Present investigation is based on the examination of 200 brown rats, *Rattus norvegicus,* which were collected at random from the houses of Hyderabad city and its adjoining areas. They were kept in laboratory (4 rats/cage) and fed with food and water *ad libitum.* Autopsy of rats revealed the presence or absence of natural infection caused by the endo-parasites in these hosts. In the text the term infected rats refers to those harbouring endoparasites, whereas non-infected rats means control rats.

Collection of parasites from the rats

Viscera were completely exposed by transverse cut in the body of the rats anaesthetized by chloroform. The gut and other organs (liver, lungs, spleen etc) were examined for parasites. The method of Fatima (*Ecto and endo-parasites of rat* (Rattus rattus) *of Multan and Khanewal (Punjab, Pakistan)* M.Sc. thesis, Institute of Pure and Applied Biology (Zoology Division). Bahauddin Zakria University, Multan, 1991) was adopted for preservation and fixation of cestodes and bladder worm stages. Nematodes were collected and preserved by the technique described by Cable (*An illustrated laboratory manual of parasitology,* 5th ed. Surajeet Publications through Shelley

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Table I.- Erythrocyte Sedimentation Rate, Mean±SEM (n), in male and female rats *(R. norvegicus)* naturally infected with endo-parasites.

Nature of infections	Male		Female	
	ESR (mm in 1st hr)	% change	ESR (mm in 1st hr)	% change
Non-infected (Control)	1.1±0.02 (15)	Nil	1.1±0.05 (25)	Nil
Protozoan infection	2.5±0.22 (5)**	+127.27	1.78±0.11 (21)**	+61.82
Cestode infection	1.2±0.08 (10)	+9.09	1.72±0.16 (32)*	+54.18
Bladder worm infection	1.08±0.05 (12)	-1.82	1.17±0.07 (20)	+6.82
Nematode infection	1.3±0.12 (5)	+18.18	2.11±0.31 (9)**	+91.82
Mixed infection	1.83±0.25 (18)***	+63.36	2.07±0.14 (28)**	+88.18

Mean±SEM, student's `t' test; *P <0.05, **P< 0.01, ***P<0.001, + Increase, - Decrease.

Enterprises, Delhi, 1985). Giemsa's method of staining of blood smears as described by Belding (*Textbook of parasitology,* 3rd ed. Appleton-Century-Crofts, Division of Meredith Publishing Company, New York, 1965) and Tagliasucchi and Carboni (*Let's observe the blood cells,* Giorgio Carboni, 1997) was adopted.

The haematozoans and endo-parasites recorded from the *R. norvegicus* were identified with the help of the keys and description given by Yamaguti (*Systema helminthum,* vol. II. *The cestodes of vertebrate*. Interscience Publisher Inc., New York, 1959), Soulsby (*Heminthes, arthropods and protozoa of domesticated animals,* 6th ed. Bailliere, Tindall and Cassell, Ltd. London, 1978) and Cable (*An illustrated laboratory manual of parasitology,* 5th ed. Surajeet Publications through Shelley Enterprises, Delhi, 1985).

Determination of ESR

Blood samples were collected from the heart of anaesthetized rats by the syringe and immediately transferred to the vial containing a mixture of ammonium and potassium oxalate as anticoagulant (Wintrobe, *Clinical hematology,* 5th ed. Lea and Febiger, Philadelphia, 1961). The ESR was determined according to Wintrobe's method (Ghai, *Textbook of practical physiology,* 4th ed. Jaype Brothers Medical Publishers (P) Ltd. pp. 143-185, 1993). The ESR values are expressed as millimeters in the first hour.

Statistical analysis

Data obtained were subjected to Student's t-test to determine the significant difference between control and Infected rats, statistical significance was accepted at P<0.05 (Rohlf and Sokal, *Statistical tables,* 2nd ed., W.H. Freeman, New York, 1981).

Results and discussion

A total of 200 rats, *Rattus norvegicus* (85.29 ±2.53g body weight), comprising 65 males and 135 females, were examined to determine ESR in the presence or absence of parasites.

During present study Protozoans *(Trypanosoma lewisi* and *Plasmodium berghei)* were recorded from the blood of the rats examined. Cestodes *(Hymenolepis nana* and *Hymenolepis diminuta)* and nematodes *(Aspicularis pakistanica)* were obtained from the intestine of the host (*R. norvegicus).* Bladder worm stages *(Cysticercus fasciolaris)* of the cestode *Hydatigera taeniaeformis* were recovered from the liver of the rats. The infection caused by the two or more different types of parasites in the same host is referred as "mixed infection". The ESR values recorded during different types of parasitic infection in male and female rats (*R. norvegicus)* are presented in Table I.

Current study revealed significant ($p < 0.001$) higher values of ESR both in male and female rats by 127.27% and 61.82%, respectively as compared with control rats during protozoan infection. Similarly mixed infection also caused significant elevation of 63.36% and 88.18% in ESR values recorded from male ($p < 0.02$) and female ($p < 0.001$) rats, respectively. Same haematological parameter was also found to be significantly increased by 54.18% and 91.82% respectively during cestode ($p < 0.01$) and nematode ($p < 0.001$) infections in female rats only. The rise in ESR is

based on the increase in erythrocytes aggregation (rouleaux) which is due to abnormally high plasma proteins (*e.g*., fibrinogen or beta globulin). These proteins are produced by the liver and the immune system under many abnormal conditions, such as an infection, autoimmune disease and cancer (Renee, *Medical Review* (eds. A. Husney and S.M. Shoor), pp. 1-2, 2002). There are several possible reasons for the elevation in ESR (Ghai, *Textbook of practical physiology,* 4th ed. Jaype Brothers Medical Publishers (P) Ltd. pp. 143-185, 1993; Brigden, *Am. Fam. Physic.*, **60**: 1443-1450, 1999). The present results suggest that the increased ESR in rats is due to formation of excess plasma proteins in the blood, which could be caused by the protozoan and mixed infection in both sexes of rats, and cestode as well as nematode infections in female rats only. Normal ESR was recorded from the male rats during cestode and nematode infections (Table I). Bladder worm infection in rats of both sexes also did not alter ESR as the values fall within the normal range (Table I). Normal ESR has also been reported earlier by Wintrobe (*Clinical hematology,* 5th ed. Lea and Febiger, Philadelphia, 1961) and Koepke *et al.* (*Reference and selected procedure for the erythrocyte sedimentation rate (ESR) test; Approved standard*, 4th ed. NCCLS document H2-A4, 20(27), Wayne, Pennsylvania, USA, 2000) in cachexia, neoplastic conditions of the liver, cirrhosis and chronic passive congestion. Hence the normal ESR values cannot be considered to exclude possibility of the infection in above mentioned hosts examined.

It is, therefore, apparent that most of the parasitic infections cause sex-dependent elevation in ESR.

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