

# A COMPARATIVE STUDY OF THE EFFECTIVENESS OF GAMMA-GLOBULIN OBTAINED OR WITH AVIRULENT PLAGUE CULTURES

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The emergency prophylaxis of plague may consist either of establishing a passive immunity or of treatment with various drugs, in particular the new highly effective antibiotics.

In recent years, Soviet studies have been made on means of obtaining more effective antiplague sera [1-11, and others]. An investigation of the preventive and therapeutic properties of the different protein fractions of antiplague serum have shown that gamma- and beta-globulins protect a large number of animals from plague.

The object of the present investigation has been to study the preventive properties of the gamma-globulin fractions of antiplague serum obtained by immunizing horses with killed virulent and with avirulent plague cultures.

Altogether six series of gamma-globulins were used. Series 39 and 40 were obtained from antiplague serum of horses immunized with killed virulent plague cultures (strains Nos. 117, 1435, 1525); series 41 and 42 from the serum of horses immunized with avirulent plague cultures (strains Nos. 1, 17, EV); series 43 and 44 were extracted from the serum of horses immunized by the combined method (strains Nos. 117, 1435, 1525, 1, 17, EV).

The experimental gamma-globulin series were obtained by the alcohol-water method. To avoid denaturation of the serum proteins, they were precipitated at a low temperature, and the alcohol removed by dialysis or by drying.

As a result of purification of the sera, there was a greater change in their fractional composition. These changes concerned primarily the albumin fractions. In the purified preparations their proportion fell from 18.83-28.30 to 3.82-6.74%, i.e., to a value 4-6 times less than the original amount.

Besides the marked reduction of the albumin content, there was also a considerable fall in the alpha-globulins, which were thought to be immunologically passive proteins.

In the purified preparations there was a considerable amount of gamma-globulins, and their content quite frequently rose as high as 61.59-68.68%. The beta-gamma-globulin content varied between 24.8 and 53.16%.

The purified sera contained between 92.42 and 95.98% of immunologically active gamma- and beta-gamma globulins.

The experiments to determine the prophylactic properties of the preparations were carried out on 130 white mice who were killed in four groups (three experimental and one control group). The quality of the preparations was inferred from a comparison of the survival of the treated and the control animals.

To test the effectiveness of the preparations they were injected together with the infective agent in 0.5 ml of fluid.

Infection was induced by a virulent strain of *B. pestis* No. 1435, whose lethal dose does not exceed 25 cells. The emulsion for the infection was carefully standardized in terms of the generally accepted bacteriological standard, and it was then diluted successively with physiological saline to the required standard. The infective dose was contained in 0.5 ml of physiological saline. The infection was given as 25 Dcl subcutaneously into the base of the tail, and the preparations were also injected subcutaneously, but into the abdominal wall.

The surviving animals were kept for 15 days, and were then killed with chloroform, dissected, and then studied bacteriologically.

It can be seen from the table that the greatest number of animals surviving occurred in the group which received serum and gamma-globulins from horses immunized with killed virulent plague cultures. Of the 40 animals of this group, only 5 died, and of the 20 animals treated with gamma-globulin, only one perished.

Of the 40 animals of the second group receiving serum and gamma-globulin of horses immunized with avirulent plague cultures, 20 (50%) died; gamma-globulin resulted in the survival of 50-80% of the animals.

Of the 40 animals of the third group receiving serum and gamma-globulin of horses immunized with both avirulent and killed virulent plague cultures, 11 succumbed; gamma-globulin caused 60-100% of the animals to survive.

In the different experimental groups, the plague bacteria were found equally regularly at quite remote times, from the 10th day onwards, usually in parts near the site of the injection and in the regional lymph nodes; in the control animals, the bacteria were found earlier in the organs, and appeared near the site of injection 4-5 days after infection, and in the viscera on the 6-8th day.

Therefore the effectiveness of antiplague sera and of their gamma-globulin preparations depends upon the amount of antigen used to immunize the horse. Immunization of animals with killed virulent plague cultures enables a more effective gamma-globulin to be obtained which protects 90-100% of the animals infected with 25 Dcl\*.

Pure protein preparations (gamma-globulins) have a great advantage over the initial native proteins (particularly in the case of the gamma-globulin series 39, 40, 44), and results in greater survival. The survival time of animals receiving gamma-globulin preparations was greater than that of control animals and of others immunized with native protein.

#### Prophylactic Action of Antiplague Sera, and of Their Gamma-Globulin Fractions

Group of animals	Serial number of preparation	Preparation	Number of white mice			Mean survival time of mice which died (in days)
			total	succumbed	survived	
First	39	Serum of horse immunized with virulent killed plague cultures	10	3	7	10
		Gamma-globulins	10	1	9	15
	40	Serum of a horse immunized with virulent killed plague cultures	10	1	9	11
		Gamma-globulins	10	—	10	
Second	41	Serum of a horse immunized with a virulent plague cultures	10	5	5	10.8
		Gamma-globulins	10	2	8	10.5
	42	Serum of a horse immunized with avirulent plague cultures	10	8	2	8.8
		Gamma-globulins	10	5	5	10.2
Third	43	Serum of a horse immunized with virulent killed and with avirulent plague cultures	10	4	6	13.2
		Gamma-globulins	10	4	6	13.2
	44	Serum of a horse immunized with virulent killed and with avirulent plague cultures	10	3	7	14.3
		Gamma-globulins	10	—	10	—
Fourth		Control	10	10	—	5.7

\*The advantages of immunization with antibodies from virulent plague cultures has been pointed out by many authors (N. N. Zhukov-Verezhnikov, E. I. Korob, and Iersen).

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.

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