

White Blood Cell Preservation with Yeast Extract in Stored Blood.

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The importance of vitamins of the B-complex in relation to blood formation and phagocytosis is now well recognized. Drew, Scudder and co-workers^{1,2,3} investigated the fate of cellular elements in stored blood and found that the most rapid deterioration occurred in the polymorphonuclear neutrophilic leucocytes which diminished 50% in 48 hours in heparinized and citrated preserved blood. It was therefore decided to test the effect of yeast extract on white blood cells in citrated blood.

Method. The yeast extract was dissolved in 5% sodium citrate; the final concentrations in the stored blood were 0.5% citrate and 2.2% yeast extract. The yeast extract was a purified alcoholic extract of Fleischmann's baker's yeast corresponding to Sample A as described by Cook, Kreke, and Nutini,⁴ and was obtained from them.

Twenty cubic centimeters of freely flowing venous blood were divided in half; each 10 cc portion was mixed with 1 cc of citrate, one with yeast extract and one without. Each mixture was distributed into 10 sterile test-tubes (10 x 75 mm), 1 cc into each. The tubes were stored at approximately 4°C. One tube was taken daily from each series and the cells were well mixed by rotating and inverting by hand. Total white cell counts and differential counts on smears stained with Wright's stain were then made. Experiments were run with blood from 3 donors.

Results. The total white cell count in blood (donor J. F.) with 2.2% yeast extract fell only a little over 6% in the first 3 days. This loss

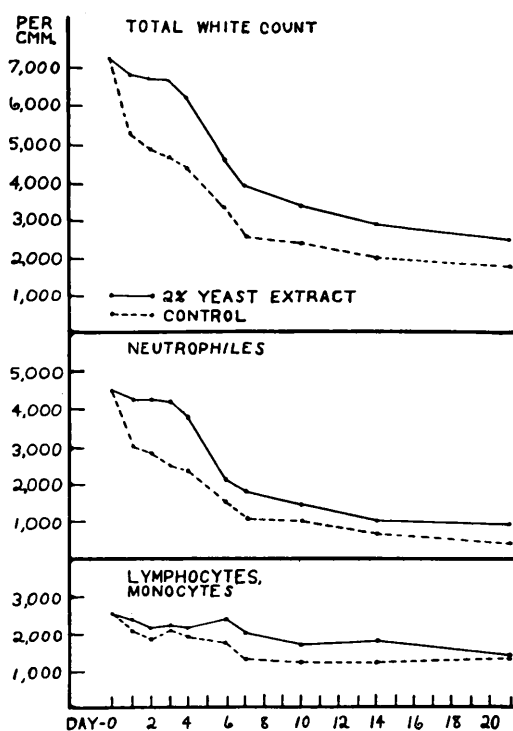


FIG. 1.

Cellular changes in citrated blood with and without 2.2% yeast extract. Donor J.F.

was almost all in the neutrophilic leucocytes (Fig. 1). In control samples there was a fall of 28% and 23% respectively in total white count in the first 24 hours. The diminution of neutrophiles was of the same order and not as rapid as in Drew's and Scudder's experiments. This may have been due to the smaller samples and narrower tubes. After 4 days with yeast extract the neutrophiles had decreased by 50%, but the lymphocytes and monocytes showed total losses of only 15 to 25%. After one week the total white count of controls was about the same as in Drew and Scudder's report. In the treated blood the total white count remained slightly but consistently higher from the end of the first week to the end of 30 days.

¹ Drew, C. R., Edsall, K., and Scudder, J., *J. Lab. and Clin. Med.*, 1939, **25**, 240.

² Drew, C. R., and Scudder, J., *J. Lab. and Clin. Med.*, 1941, **26**, 1473.

³ Scudder, J., Drew, C. R., Tuthill, E., and Smith, M. E., *Bull. N. Y. Acad. Med.*, 1941, **17**, 373.

⁴ Cook, E. S., Kreke, C. W., and Nutini, L. G., *Studies Inst. Divi Thomae*, 1938, **2**, 23.

Trager⁵ found that concentrations of 0.7% and 0.14% of yeast autolysate improved the survival of malaria parasites *in vitro*, with 0.7% as optimum. Another experiment was therefore run in the same manner with blood from donor D.D. This blood was divided into 3 portions, including a control set with final concentrations of 1.1% and 0.22% of yeast extract in 0.5% sodium citrate. This blood showed a somewhat high original total white count of 9,500 which had fallen to 3,000 on the sixth day in the control. A marked difference was shown between the white cell population in the 3 sets during the first 5 days. In the control the total white count fell by 2,300, which was only 23%, and was then held at this level for 2 more days before it began to fall rapidly. The blood with 1.1% yeast extract maintained the white cell population with scarcely any loss for 48 hours. They then decreased gradually for 2 more days, after which their total fell quickly. The daily total white cell count with 0.22% yeast extract was higher than in the control but less than with 1.1%; it fell gradually by 17% up to the third day, and was then arrested for 24 hours before falling rapidly as in the other sets. By the end of a week there was no appreciable difference between this blood and the control; but the blood with

1.1% yeast still showed a total white cell count 25% higher than the control.

In all experiments the decrease in total white cell count was found to be due mainly to loss in polymorphonuclear neutrophilic leucocytes and the 2 curves were always similar to those shown in Fig. 1. The lymphocytes, in contrast, decreased very gradually and by the third or fourth day they seemed to show a slight increment over the first and second day; this is also evident in the curves of Drew and Scudder. After one week they remained fairly constant at about 75% of their original number in blood with 2.2% and 1.1% yeast extract and at about 50% of their original strength in the controls.

Other Cellular Elements. Observations on monocytes, eosinophiles, and basophiles confirmed the findings of Drew and Scudder.^{1,2} The platelets and erythrocytes were not investigated. In all experiments, after 3 or 4 weeks there was noticeably less hemoglobin in the plasma with yeast extract than in controls.

Summary. The addition of 2.2% and 1.1% of yeast extract to citrated blood kept the total white count close to normal for 3 or 4 days. The improvement was due chiefly to a delay in the disintegration of the neutrophilic leucocytes, but the number of lymphocytes also remained consistently somewhat higher than in the controls for a month.

⁵ Trager, W., *J. Exp. Med.*, 1943, **77**, 411.