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Influence of Arsenic, Ferrous Sulphate and Copper Sulphate on Rats Furnished A Vitamin A-Free Diet with Iron Added.

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In order to ascertain the extent to which minerals may act as catalyzers and replace the so-called "vitamins", we have been performing experiments with a number of chemicals added in minute doses to the food of experimental rats, showing unmistakable signs of avitaminosis. Our experiments with iron and iodine[1] having proved successful, it was deemed wise to try preliminary experiments in which copper was exhibited in the presence of iron and arsenic. In a series of experiments with 15 negative control and 8 positive control rats, 6 other animals were placed on a diet that included ferrous sulphate, iron iodide, arsenic and copper sulphate added to the Sherman A-free diet No. 380.

FIRST LOT: 2 male animals received daily 1 drop of a solution of copper sulphate, such that it added to their food 0.01 mgm. of copper. They received 1 drop of ferrous sulphate solution containing 0.5 mgm. of iron and 0.01 mgm. of ergosterol, which had been irradiated together with a small quantity of the Sherman diet No. 380. They also received in the drinking water, 1 cc. of dilute Fowler's solution of arsenic containing 0.379 mgm. of arsenic.

Beginning with an average weight of 42 gm., they reached a maximum weight of 175 gm. at the end of 9 weeks. After fluctuating around 170 gm. for 2 weeks a rapid decline resulted in death at the end of 13 weeks. Autopsies showed that in one case the left ear and left adrenal were infected while the other specimen had infected kidneys, testis and gall bladder.

SECOND LOT: In another lot of 4 females, receiving Sherman diet No. 380 and irradiated ergosterol, 1 drop of ferrous sulphate solution and 5 drops of dilute syrup of the iodide of iron, the experiments were also unsatisfactory. Averaging 53 gm. at the beginning of the experiment, they reached a maximum of 160 gm. at the end of 12 weeks. For 7 weeks they fluctuated around 157 gm. The results indicated storage but no benefit. Autopsies showed 2 with

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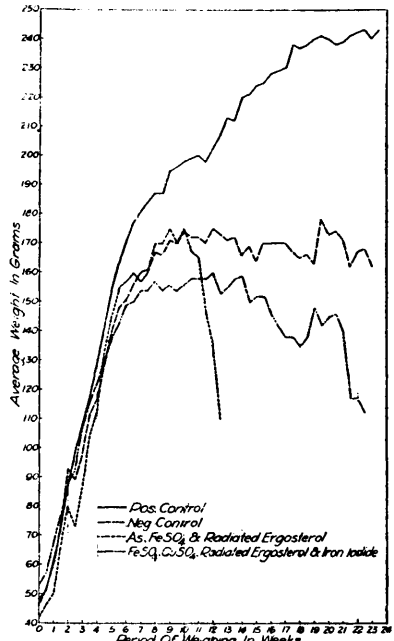
[1] Chidester, F. E., Eaton, A. G., and Thompson, G. P., *Science*, 1928, lviii, 432.

infected gall bladders, 3 with infected lungs, 1 with infected thyroid and 1 with no apparent infections.

Hart and associates[2] found that .01 mg. of copper sulphate given daily to rats in addition to 0.5 mg. of iron was effective in curing anemia in from 2 to 3 weeks. Our results differ in that the effect noted by the Wisconsin investigator did not persist. (See graph.)



THE INFLUENCE OF ARSENIC, FERROUS SULPHATE AND COPPER SULPHATE ON RATS FURNISHED A VITAMIN A FREE DIET

Our animals were run on vitamin A deficient diet for over 3 months and naturally, even if the minerals furnished did act as catalyzers and make available the stored food, the experiments cannot be compared to one in which an *adequate* diet was furnished.

It is interesting to note, however, that in anemia produced by bleeding, Whipple[3] and associates at Rochester University found that iron was more potent than either copper or zinc.

We hope later to find the optimum minute amount of copper that will be effective in combination with other minerals that we have recently established as catalyzers of value in avitaminosis.

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[2] Hart, E. B., Steenbock, H., Waddell, J., and Elvhjem, *J. Biol. Chem.*, 1928, lxxvii, 797.

[3] Whipple, G. H., Robscheit-Robbins, F. S., Elden, C. A., and Sperry, W. M., PROC. SOC. EXP. BIOL. AND MED., 1928, xxv, 748.