

Iowa Section.

Iowa State College, Ames, Iowa, December 4, 1930.

5332

Rôle of Copper in Hemoglobin Formation.

H. L. KEIL AND V. E. NELSON.

From the Laboratories of Physiological Chemistry, Iowa State College.

The hemoglobin value of the blood of rats on our growing ration varies from 15 to 18%. The hemoglobin content of the blood of rats on whole milk falls to 2 to 5% in 10 weeks. The females respond to anemia and die sooner than the males. Ferric chloride increased the hemoglobin to 16% in 9 weeks. The ferric chloride was made from high grade standardization iron wire. The wire was dissolved in pure HCl to which was added a small amount of pure HNO₃, and H₂S was bubbled through the diluted solution to precipitate any copper present. The chloride was then crystallized. The Hilger spectrograph showed no copper in the ferric chloride or ferric chloride solution. Ferric chloride from electrolytic iron caused hemoglobin regeneration so that in 9 weeks a value of 16% was obtained. The electrolytic iron, FeCl₃, and FeCl₃ solution were copper free as shown by the Hilger spectrograph. If CuSO₄ be given with the ferric chloride, regeneration is quicker and requires 4 weeks to reach a value of 2.2% higher than without copper.

Rats in glass cages with glass screens did not become anemic any sooner than rats in cages with galvanized screens. Rats on shavings did not develop anemia in 20 weeks. Anemic rats were given sucrose dissolved in copper free water. One lot received in addition pure FeCl₃, another lot received 3.0 mg. copper as CuSO₄ per rat daily, and the third lot received sucrose and distilled water. The FeCl₃ lot had a hemoglobin value of 15% in 3 weeks. The CuSO₄ lot showed a slight gain in hemoglobin, due to a small amount of iron in the c.p. CuSO₄. The control lot showed no gain in hemoglobin, so after 2 weeks each rat was given daily 0.2 mg. of Fe as FeCl₃; and in 2 weeks the hemoglobin increased from 5 to 12%.

Manganese (0.1 mg. Mn per rat daily) as MnCl_2 when fed with FeCl_3 to anemic rats did not increase the value of hemoglobin above the value obtained on iron alone. Rats on whole milk, wheat embryo oil, and FeCl_3 did not reproduce. Copper sulphate addition to the above ration resulted in normal reproduction—3 females producing 9 litters of 59 young in 109 days. Lactation was fair. The milk used analyzed between 0.35 and 0.44 mg. Cu per liter. The cane sugar contained no copper. Unless otherwise indicated the FeCl_3 was fed at a level of 0.5 mg. Fe and the CuSO_4 was fed at a 0.05 mg. Cu level.

5333

Cod Liver Oil for Reproduction and Lactation.

H. O. SMITH AND V. E. NELSON.

From the Laboratories of Physiological Chemistry, Iowa State College.

Previous work in this laboratory has emphasized the fact that cod liver oil contains vitamin E. Some investigators have not had success with cod liver oil as a source of this vitamin, so it was deemed advisable to test different cod liver oils for their potency in the reproductive vitamin. The rations consisted of casein 18.0, salt mixture 185, 3.7, yeast 12, different cod liver oils from 1 to 5, and dextrin to 100%. Eight cod liver oils were examined. The growing ration served as a control and was outstandingly the best of the group. The growing ration gave a value of 5.4, whereas the oils gave the following figures: 1.79, 1.12, 0.88, 0.73, 0.72, 0.66, 0.56, and 0.08. The figures represent the number of young produced per female per month on each ration. Some of the oils contain far more vitamin E than others, although they contain less than some of our natural foods.

The mortality of the young varied with the kind of oil and the level at which administered. Five percent of one oil gave a mortality of 18%, while the same amount of another oil gave a mortality of 100%. The mortality with the first oil was no higher than on the growing ration. A 3% level of the better oil mentioned above gave a mortality of 9%, whereas the other oil gave a mortality of 70%. A considerable number of females died in pregnancy on the various cod liver oil rations. The mortalities of the females in pregnancy on the different oils, expressed as percent, were: 14, 5, 43, 36, 17, 19, 4, and 39. There appeared to be no relation between the mortality of the female and the potency of the oil in vitamin E.