

It is common knowledge that extraneous proteins protect bacteria and viruses against heat and ultraviolet light, and we have found that the papilloma-virus in crude suspension resists more heat³ and ultraviolet light⁴ than after Berkefeld filtration or partial purification by differential centrifugation. It seems probable that the protection of the papilloma-virus from X-rays by normal serum or by extrinsic material present in papilloma-extracts is also due to extraneous protein. Further work must decide what the findings imply as regards the mode of action of X-rays on biologically active materials.

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Minimum Daily Requirement of Rabbits for α -Tocopherol.

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During the past year we have been studying the vitamin E requirement of rabbits for the cure and prevention of nutritional muscle dystrophy. Recently, MacKenzie and McCollum¹ reported that the rabbit requires 0.7 to 1.0 mg of α -tocopherol per kg of body weight, but this does not quite agree with our findings. In our experience, rabbits made dystrophic on the Goetsch-Pappenheimer diet 13 were cured by the daily oral administration of synthetic dl- α -tocopherol acetate in quantities ranging from 0.18 to 1.0 mg per kg of body weight, with most of the cures resulting from doses of 0.2 to 0.5 mg (as free alcohol).

We found that a definite correlation exists between the higher requirements and the *total* α -tocopherol intake. When animals with an apparently high vitamin E requirement were subjected to a new test on a smaller *total* tocopherol intake, their requirement dropped to a lower level (values ranging from 0.2 to 0.4 mg per kg). These findings suggest that the higher values, as well as the wider range of variation in the requirement values, are not so much an outcome of individual variability in the need of the tissues for vitamin E as of variations in the efficiency of absorption, in ability for storing and in the rate of destruction of the vitamin.

³ Friedewald, W. F., and Kidd, J. G., *J. Exp. Med.*, 1940, **72**, 531.

⁴ Unpublished experiments.

¹ MacKenzie, C. G., and McCollum, E. V., *J. Nutrition*, 1940, **19**, 345.

In addition to the experiments with diet 13, we also fed rabbits our diet X 113 from which vitamin E is removed by an exhaustive extraction with lipid solvents. Rabbits on this diet become dystrophic as readily as on diet 13, in which vitamin E is destroyed by oxidation with FeCl_3 and rancid fat. We treated rabbits made dystrophic on diet X 113 with much smaller *total* amounts of α -tocopherol than were used with most animals fed diet 13. In the former the total amount administered did not exceed 60 mg per rabbit, while in the latter quantities up to 222 mg were used. Because of the relative freedom from rancidity of our diet X 113 and of the lower level of intake of tocopherol, the vitamin E requirements of the rabbits in this group were generally lower and varied within a narrower range, as would be expected if our assumption is correct. In the experiments with diet X 113 the requirement was found to range from 0.15 to 0.60 mg, and only few of the values so determined were outside the range of 0.20 to 0.40 mg per kg.

A few experiments were also made using the lipid extracted diet from which cod liver oil was also excluded. Instead of the cod liver oil additions, a few drops of 50% percomorph oil and a few drops of linseed oil were administered as separate supplements once a week. On such a diet the danger of vitamin E destruction is still further minimized.² Although these studies are only preliminary, even from the results so far obtained it seems very probable that the vitamin E requirement of these rabbits is actually only about one-half as great as was found to be the case in the other experiments.

These studies bring to light two important facts: (1) that the absorption from the gut may vary widely and that destruction in the gut or in the tissues, or in both, may be excessive resulting in some animals in a real vitamin E deficiency; (2) since synthetic dl- α -tocopherol suffices to prevent or to cure muscle dystrophy, components of the vitamin B complex may exert a favorable action³ indirectly by protecting the vitamin E from destruction, possibly through an effect on the redox potential. Only the availability of synthetic α -tocopherol made a definite solution of the problem possible.

From our present experiments it seems probable that the rabbit requires 0.2 to 0.4 mg vitamin E per kg of body weight to cure and prevent the development of muscle dystrophy, and it is possible that, when more data become available by our improved dietetic technic, this value may be reduced even to about 0.1 mg.

² Morris, S. G., *Science*, 1939, **90**, 424.

³ Morgulis, S., Wilder, V. M., and Eppstein, S. H., *J. Nutrition*, 1938, **16**, 219.