Effect of Rutin on the Biological Potency of Vitamin C

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The biological potency of vitamin C in different natural sources has only recently become known, and subsequent findings require explanation. Work carried out in this laboratory has shown that the ascorbic acid of certain foodstuffs has a higher apparent biological value, at the lower levels of vitamin intake, than is shown by chemical assay. We have demonstrated in the case of fortified tomato juice and fortified orange juice, and with stored cabbage and dehydrated potato, that chemical methods of assay underestimated the biological potencies, as determined by the odontoblast method of assay. This evidence appears to support the hypothesis that a factor in natural vitamin C carriers increases the biological value of ascorbic acid beyond that expected from chemical analysis.

In the quest of this unknown factor, all evidence pointed to a substance with vitamin P activity. Griffith, Couch, and Lindauer (*2*) fed rutin, a flavonal glycoside, to 14 patients with hypertension, all of whom subsequently showed increased resistance in the capillary walls. This work was confirmed by Shanno (*3*). Ambrose and DeEds (*1*) administered rutin to rabbits, and found that it decreased cutaneous capillary permeability. Furthermore, Wilson, Mortarotti, and DeEds (*4*) showed that rutin prolongs the action of epinephrine on intestinal strips, the prolongation presumably being due to a protection of the epinephrine from oxidative destruction. Based on this information, we postulated that rutin might be one factor responsible for enhancing the biological potency of ascorbic acid in certain natural sources of the vitamin.

This note is a preliminary summary of an experiment carried out in this laboratory to ascertain the biological value of vitamin C in two natural sources of the vitamin, and to test the effect of added rutin on the apparent vitamin C potency of these substances, as well as on synthetic ascorbic acid. The assay included 96 guinea pigs, divided into three equal groups, each group containing equal numbers of both sexes. As the only source of vitamin C, the first or control group received crystalline ascorbic acid, the second group received canned orange-grapefruit juice, and the third group received dehydrated potato. Each assay material was fed at four different levels of vitamin C content, these levels being 0.5, 0.79, 1.26, and 2.00 mg of ascorbic acid per day. The amounts of orange-grapefruit juice and dehydrated potato to be fed were based on chemical analyses of samples of the two materials. Half the animals on each assay material were fed orally 100 mg per day of crystalline rutin.

Using the odontoblast method of assay, it was found that the rutin treatment gave significantly higher values on the response-dose curve at the 0.5, 0.79, and 1.26 mg levels of vitamin C intake for both the synthetic ascorbic acid and orange-grapefruit juice assays (Fig. 1). At the lower levels of vitamin intake, it appears that rutin either makes more available or delays *in vivo* destruction of ascorbic acid in the original source. A further distinct possibility is that rutin forms the basis for synthesis by the animals of additional ascorbic acid. This postulation follows from the similarity between the glucose-fructose side chain of the rutin molecule, and the actual structure of some of the many forms of ascorbic acid. Therefore, rutin, present in some natural vitamin C sources, might be considered to be the factor responsible for enhancing the apparent biological potency of vitamin C.

Because of the very low vitamin C content of dehydrated potato, it was impossible to get the animals, even

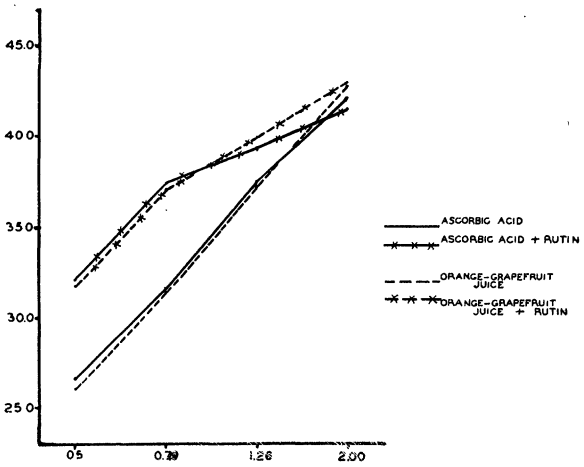

FIG. 1. Effect of supplementary rutin on the response of guinea pigs to increasing doses of vitamin C. Abscissas represent mg ascorbic acid/pig/day; ordinates represent odontoblast height in microns.

by forced feeding, to consume enough of this material to meet the necessary levels of ascorbic acid. This resulted in the death of approximately half of these animals due to advanced stages of scurvy with ultimate starvation. Since the intake of dehydrated potato was inadequate and inconsistent, the variability of the results obtained with the survivors was very high. For this reason it was thought inadvisable to include quantitative data on these findings in this report, although the effect of rutin was again apparently to raise the biological potency of vitamin C in the dehydrated potato.

It may be tentatively concluded that the enhanced biological value of vitamin C observed in this test is due to the flavonal glycoside, rutin. However, the mechanism of action of rutin is as yet undetermined.

References

1. AMBROSE, A. M. and DEEDS, F. *J. Pharm. exp. Therap.*, 1947, **90**, 4 :359.
2. GRIFFITH, J. Q., COUCH, J. F., and LINDAUER, M. A. *Proc. Soc. exp. Biol. Med.*, 1944, SS : 228.
3. SHANNO, R. L. *Amer. J. med. Sci.*, 1946, **211**, 539.
4. WILSON, R. H., MORTAROTTI, T. G., and DEEDS, F. *J. Pharm. exp. Therap.*, 1947, **90**, 2 : 120.