

## **Ester-C Bioavailability Study Report**

*Extracted from "Vitamin C The Future is Now" by Jeffery Bland, Ph.D 1995*

A number of human and animal studies have explored the absorption and physiological effects of Ester-C mineral ascorbates in comparison to normal vitamin C. These studies have yielded exciting new information about the nature of Vitamin C and its metabolites.

In one animal trial, Dr. Anthony Verlangieri and his colleague, Marilyn Bush, fed two groups of rats equal amounts of either ascorbic acid or Ester-C. They tested the blood and urine levels of vitamin C in these animals for four hours after oral administration. The animals fed the Ester-C had higher blood levels of vitamin C, suggesting an improved rate of absorption in comparison to normal vitamin C. Vitamin C was not detected in the urine of the Ester-C group until long after it was discovered in the urine of the group fed normal vitamin C. This delay in excretion suggests better tissue utilization of the Ester-C before it "spilled over" into the urine. Verlangieri stated that this improved absorption and tissue uptake appeared to be due to the vitamin C metabolite threonic acid, which is present in Ester-C.

Except for some bats and the guinea pig, all lower mammals, including the rat, manufacture their own vitamin C. One strain of rat-Japanese ODS rat- is defective in its ability to manufacture its own ascorbic acid, however, and ODS rat are now widely used by vitamin C researchers for laboratory studies of this nutrient. These rats develop scurvy if they do not have a source of vitamin C in their diet.

Drs. Verlangieri and Fay took advantage of the inability of ODS rats to manufacture ascorbic acid to evaluate the bioavailability of Ester-C calcium ascorbate. To one group of mildly vitamin C-deficient ODS rats, they administered Ester-C calcium ascorbate containing metabolites. The minimum dose of Ester-C to prevent scurvy was determined after 24 days. When an equivalent amount of ordinary vitamin C was administered, it was inadequate to prevent scurvy. The result of this experiment further confirmed that, in an animal model, Ester-C is more bioavailable than normal vitamin C.

In 1990 this concept was tested in human by Jonathan Wright, MD of the Kent-Meridian Clinical laboratory in Washington State. The human bioavailability study was designed to compare the absorption, retention and utilization of Ester-C and ordinary vitamin C. Absorption was measured by vitamin C levels in the plasma fraction of blood. Retention was inferred from the urinary vitamin C levels at different times after supplementation. Finally, tissue utilization was assessed by measuring the amount of vitamin C in white blood cells, which are known to accumulate and utilize large amounts of vitamin C for many physiological functions.

A more focused study of Ester-C's effectiveness was performed recently in San Diego by Dr. Howard Hunt, Professor Emeritus of the University of California San Diego, and Dr. Thomas Rice of the Life Management Group with a group of men enrolled in a corporate fitness program. They wished to see if Ester-C would significantly increase tissue levels of vitamin C in infection-fighting and immunological cells, as measured by uptake of ascorbate into the white blood cells.

Their research plan was very similar to that Dr. Wright's earlier study. The subjects began with two-week washout period to stabilize their vitamin C intake at low levels. Group of 18 men each then received a one gram oral dose ascorbic acid in one of the three product forms: ascorbic acid, Ester-C calcium ascorbate, and the Ester-C ascorbate with a standardized 3 percent calcium threonate level. White blood cells were isolated from blood samples removed at intervals of 0,1,2,4 and 24 hours from the time of administration.

Hunt and Rice discovered that, with time, the ascorbate from all supplements steadily accumulated in white cells, but that Ester-C ascorbate and the Ester-C with added threonate reached levels of 300 percent and more than 400 percent, respectively, above the final baseline level attained with ordinary ascorbic acid. They concluded that Ester-C calcium ascorbate/threonate complex provided a superior way to build vitamin C reserves in the important immunocompetent cells of the blood, even using modest levels (one gram) of supplementation. The standardized threonate group showed further intracellular increase of ascorbate; this is the subject of ongoing studies.

At present, the weight of evidence concerning the Bioavailability of Ester-C seems to indicate it is different from that of normal vitamin C, and it appears to benefit from the presence of the threonate and other vitamin C metabolites which help improve its absorption and tissue uptake. Dr. Verlangieri's work on the influence of threonate on the absorption of vitamin C metabolite which is present in Ester-C enhances absorption.