FOOD STATE SUPPLEMENTS by Dr Paul Clayton

We were not designed to swallow vitamin pills; we were designed to consume food. But as activity levels continue to fall, and dietary intakes decline (calorific intake is down 30% in the last 50 years alone), the incidence of multiple micronutrient depletion continues to increase. As a consequence, the need for additional micronutrients is probably greater now than at any time in the last century.

But are the USP vitamins and inorganic minerals used in so many supplements really the solution? Recent work shows that they may be considerably sub-optimal delivery systems for the micronutrients we need - and that Food State supplements offer considerable advantages.

Food State supplements present vitamins and minerals in a format as close as possible to the foods where those micronutrients naturally occur. Food State vitamin C, for example, is presented in a citrus extract, which also contains the flavonoids naturally present in citrus fruit. In Food State selenium, on the other hand, the mineral is presented in a variety of bound forms in a yeast substrate.

There are clear reasons for these choices of substrates, and equally clear advantages.

FOOD STATE VITAMINS

USP Vitamin C, for example, is notoriously unstable, and degrades rapidly during heating - which is why the vitamin C content of foods falls during storage, and especially during cooking. Food State vitamin C, in marked contrast, is stable enough to survive cooking almost untouched, showing only 5% loss over a full pasteurisation cycle (Cytoplan Ltd internal report, available on request). This is because in Food State the vitamin C is stabilised by carrier or chaperone molecules, which protect it from degradation - the same molecules which help maintain ascorbates in reduced form in the live fruit.

Critically, from the health point of view, Food State vitamin C is better absorbed than USP C. In comparative animal (1) and human trials (2), Food State C provides nearly double the plasma protection (AUC) of USP vitamin C. This enhancement is probably due to the improved stability of Food State C in the small bowel (3), and to the flavonoid-enhanced storage of Food State C in the liver (paper cited in Vinson 91) Because of these improved uptake and storage characteristics, Food

State C enters the bloodstream slightly later than USP vitamin C, but reaches higher levels and stays there longer (1, 2). Food State C also achieves higher levels in erythrocytes (red blood cells) (5), which is thought to confer other benefits (see below).

When citrus extract is combined with vitamin C, the naturally occurring flavonoids in citrus extract confer synergistic antioxidant activity, giving the combination an antioxidant capacity up to an order of magnitude greater than the equivalent amount of USP vitamin C (4). This synergistic action, together with the fact that Food State C achieves higher levels in erythrocytes than USP C (5), helps to explain why Food State vitamin C is more bio-effective than USP vitamin C.

For example, the glucose metabolite sorbitol accumulates in tissues as glucose plasma levels increase (ie in diabetes), and is implicated in causing the long-term complications of diabetes such as retinopathy, cataracts, renal damage and atherosclerosis. Compared to USP Vitamin C, Food State C is more effective at lowering erythrocyte sorbitol levels in human subjects (5). In diabetic subjects, Food State C reduced erythrocyte sorbitol by 44.5% (5).

In related animal studies, Food State C was more effective than USP C at protecting rats from sugar-induced cataracts (6), reducing both their numbers and severity. In hypercholesterolaemic hamsters, Food State C was more effective than either USP C or flavonoids on their own at lowering LDL cholesterol levels, inhibiting cholesterol oxidation, and as a result strongly inhibiting atherosclerosis (7).

Finally, Food State was found to be highly effective at preventing AGE formation in human subjects, cutting it by 46.8% (8). AGE, or Advanced Gylaction End-products, are formed when high levels of glucose react with proteins, denaturing them and leading to loss of protein functions. AGE formation is increased in diabetes, and, as with increased sorbitol levels, is another important cause of diabetic complications.

FOOD STATE MINERALS

Food State is equally suited to the enhanced delivery of trace metals. Delivery of copper (9), manganese (10) and zinc (11, 12) are all improved, but the data for selenium is a particularly good example.

Food State Selenium has better bioavailability than either Selenite or

Selenium Chelate (13). At the same time it is considerably less toxic; its LD50 in rats is three to five times higher than that of inorganic selenium. (14).

In animal models, Food State Selenium is more effective at inhibiting LDL cholesterol oxidation than both inorganic Selenite and selenomethionine (15). This shows that Food State Selenium is more bio-effective than inorganic selenium, as the increased antioxidant protection is due to selenium which has been incorporated into glutathione peroxidase, an important antioxidant enzyme which protects the body against the toxic effects of cholesterol oxidation.

Similarly enhanced human bio-efficacy is demonstrated by Food State Chromium, which is more effective in reducing blood glucose levels than inorganic chromium (16): and Food State Calcium, which is more effective than calcium gluconate at lowering diastolic BP in normotensive subjects (17).

The enhanced bioavailability and bioefficacy of Food State products are related to their presentation. In the foods in which micronutrients are found, those micronutrients are not present as simple USP molecules; rather, they are partitioned, and bound to carrier or chaperone molecules which protect them, and deliver them to the sites where they will be stored or used. The chaperone molecules have a dual role, because they also shield the tissues from the potentially destructive effects of certain micronutrients such as copper or zinc, until these can be safely delivered to their storage sites. (Rouhi).

The chaperone molecules in yeast are believed to be similar to those in humans; and this helps to explain why Food State micronutrients are better absorbed, better tolerated and more bioeffective than their USP equivalents.

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