CPQ Nutrition (2019) 3:3
Perspective

Nutrient-Nutrient Interactions

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Received: 11 January 2019

Published: 28 February 2019

Keywords: *Nutrient-Nutrient Interactions; Nutrient Dosage; Multi-Nutrient Supplements*

Acknowledging that nutrient-nutrient interactions are often overlooked, research addressing the competition between nutrients and how this affects the function and bioavailability of dietary compounds remains paramount [1]. Some of the known interactions between commonly consumed micronutrients in supplementary form - and how absorption and overall efficacy may be influenced-are discussed below. Clearly this is not an exhaustive list, but rather a reminder of the minutiae of dietary supplement formulations.

Iron, Copper and Zinc

Dietary iron is present in two distinct forms: hem and non-hem. Hem-iron derives from haemoglobin; the iron-containing protein found as part of red-blood cells which have the unique ability to carry oxygen; while non-hem iron is the form found in plant-based foods. It is generally accepted that hem-iron, found in animal-based foods, is absorbed more effectively than non-hem iron. The iron found in multivitamin formulations and in fortified foods is in most cases almost exclusively of plant origin. Its ability to be absorbed can be influenced by other common ingredients found in multi-nutrient dietary supplements. Since the process of absorption is a dictated by their chemical characteristics including charge and molecular shape; copper, zinc, and iron all share similar absorption mechanisms. With this in mind, what does this mean if all three are consumed at the same time?

Iron is transported into corporal cells by means of a receptor specially located on the cells of the duodenum, the initial section of the small intestine, to which food is initially exposed after digestion in the stomach. This receptor however, has been shown to be additionally involved in the absorption of both copper and zinc - though with distinctive affinities for each mineral. Research has demonstrated highest affinity for iron [2].

So what does this mean at a practical level? If these nutrients were to be taken at the same time, it is possible that some nutrients will be unabsorbed and, effectively, remain useless to the body.

A strong point that must remain under consideration is nutrient dosage. It has been suggested that supplemental iron, at levels of 38-65mg/day, may lessen zinc absorption and additionally impact copper absorption. This does not seem to be the case for dietary iron. Likewise, similar studies have demonstrated that high levels of zinc and copper may interfere with iron uptake. It has been suggested that high zinc intake induces the production of a copper-binding protein, which "traps" the mineral and prevents its absorption [3].

Iron, Calcium, Magnesium and Manganese

Two commonly found mineral components in multi-nutrient supplements, magnesium and manganese, also interact with iron. Magnesium may decrease non-hem iron absorption if the two nutrients are taken together. Simultaneous intake of both iron and magnesium is thought to negatively impact manganese absorption [4]. It has been suggested that calcium decreases non-hem iron absorption when both are consumed simultaneously. This however may only be a problem if iron-deficiency is already present [5].

Iron and Vitamins C and A

Nutrient-nutrient interfere with absorption has thus far been discussed, but do any nutrients have the ability to enhance absorptive ability? Indeed. Vitamin C, an antioxidant found in most multi-nutrient supplements, is suggested to enhance non-hem iron absorption when both nutrients are eaten together [6]. Similarly vitamin A, and more specifically beta-carotene, appears to augment iron absorption. The mechanism has been describes as vitamin A's ability to move iron from its storage site into red blood cells, where it is used to build haemoglobin. Nonetheless, studies suggest that vitamin A is unlikely to enhance iron absorption in those with adequate levels of vitamin A; rather, it is more likely to improve iron status in those with low levels of vitamin A [7].

Vitamin A, E and K

Nutrient-nutrient interactions vary in nature; that is, absorption may not be the only way in which certain nutrients can influence the activity of other nutrients. In the case of vitamins, vitamin A may reduce the absorption of vitamin K [7]. As it turns out, vitamin E has a similar overall effect on vitamin K as does vitamin A, yet not by inhibiting its absorption. Rather, vitamin E may lead to functional vitamin K deficiency by inhibiting the activity of vitamin-K dependent enzymes. This will effectively render vitamin K useless even if it is absorbed [8].

Having just scratched the surface of the nutrient-nutrient interaction phenomenon, how do we make sense of the information? More importantly, how can it be applied to dietary habits? Nutrient-nutrient interactions may have an effect on what the body is able to absorb from both foods and dietary supplements. This then calls the supplement industry into action for better formulation. Perhaps of higher urgency though, consumers should be aware of the likelihood that multi-nutrient supplements with a long list of ingredients are not necessarily better.

Nutrient interactions are usually of little consequence as long as well-planned meals are regularly consumed. Nutrient interactions can be of greater significance when the diet is either deficient or excessive in important nutrients, when long-term drug therapy or heavy drug or alcohol usage is involved, or during periods of increased nutrient requirements such as pregnancy or lactation.

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