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High Quality Proteins Can Impact Circulating Homocysteine Levels.

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Abstract
The amino acid composition of a protein can tell you a lot about it's health implications. For example a protein source high in sulfur amino acids (methionine and cysteine) can affect methionine metabolism and, ultimately, health. Cysteine is a conditionally essential amino acid, because it can be synthesized endogenously from methionine. Thus, when a dietary protein provides enough methionine beyond the need for cellular protein synthesis, the remaining surplus can be used to synthesize cysteine. Therefore, when a dietary protein has a cysteine concentration in balance with methionine, the need to utilize methionine for its synthesis is reduced. This is often referred to as the methionine-sparing effect of cysteine.

Disciplines
Food Chemistry | Food Processing | Food Science | Human and Clinical Nutrition | Molecular, Genetic, and Biochemical Nutrition

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High Quality Proteins Can Impact Circulating Homocysteine Levels.

By
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The amino acid composition of a protein can tell you a lot about it's health implications. For example a protein source high in sulfur amino acids (methionine and cysteine) can affect methionine metabolism and, ultimately, health. Cysteine is a conditionally essential amino acid, because it can be synthesized endogenously from methionine. Thus, when a dietary protein provides enough methionine beyond the need for cellular protein synthesis, the remaining surplus can be used to synthesize cysteine. Therefore, when a dietary protein has a cysteine concentration in balance with methionine, the need to utilize methionine for its synthesis is reduced. This is often referred to as the methionine-sparing effect of cysteine.

Why is the metabolism of methionine to cysteine important?

Besides ensuring adequate cysteine concentrations for protein synthesis, the metabolic pathways by which methionine is converted into cysteine, termed the transmethylation and transsulfuration pathways, are also important in providing methyl groups for a vast number of methylation reactions. The methyl group from methionine, in the form of S-adenosylmethionine (SAM), is the ubiquitous methyl donor in over 100 biological methylation reactions, such as the synthesis of creatine, phosphatidylcholine, and methylation of nucleic acids, an important mechanism in the control of gene expression.

A product of all SAM-dependent transmethylation reaction, prior to the formation of cysteine, is the production of the non-protein amino acid homocysteine. Homocysteine has received a considerable amount of attention in the last 20 years owing to the reports that high circulating levels of homocysteine (i.e., hyperhomocysteinemia) represents an independent risk factor for cardiovascular disease. Aberrant homocysteine metabolism has also been associated with diabetes, birth defects, other vascular diseases, cancer, and numerous neurological disorders.

What factors play a role in abnormal metabolism of homocysteine?

As mentioned, homocysteine is an intermediate in the methionine to cysteine pathway, and its metabolism is dependent on a number of essential compounds. This includes the B-vitamins folate, B6, B12, as well as betaine, a compound derived from choline. Collectively, these compounds function to re-methylate homocysteine and convert it back to methionine, and thus supply another methyl group to SAM. Two distinct pathways, one dependent on folate/ B12 and the other on choline/ betaine, have the ability to provide a methyl group to homocysteine and regenerate methionine. Conversely, homocysteine can be irreversibly catabolized to cysteine, a two-step process that also depends on B6. Regardless of which route homocysteine metabolism undergoes, a blockage of homocysteine metabolism, such as B-vitamin deficiency, results in its accumulation in tissues which eventually leads to high concentrations in the circulation.

"Aberrant homocysteine metabolism has also been associated with diabetes, birth defects, other vascular diseases, cancer, and numerous neurological disorders."

How do sulfur amino acids and eggs impact hyperhomocysteinemia?

Clearly, an optimal supply of methionine and cysteine in the diet reduces the requirement for methionine to be utilized for conversion to cysteine, thereby allowing more homocysteine to be remethylated back to methionine as opposed to catabolismed to cysteine. Therefore, dietary proteins that provide a greater balance and absolute amount of methionine and cysteine should optimize methyl group metabolism and aid in maintaining homocysteine balance.

Our laboratory has focused on evaluating dietary proteins based on their sulfur amino acid content and balance, in the context of their ability to prevent or attenuate hyperhomocysteinemia. As expected, dietary proteins with a high, balanced methionine and cysteine content could prevent the development of hyperhomocysteinemia and to date, egg white protein has been the most effective in this regard. Moreover, we have also begun to identify the mechanistic basis for egg white protein to prevent

homocysteine accumulation. In addition to the methionine/ cysteine content of egg white protein, it also has the ability to increase expression of one of the enzymes that is involved in removing homocysteine by catalyzing remethylation. Thus, we speculate that the positive effect of egg white protein on modulating methyl group and homocysteine metabolism resides in (1) the optimal sulfur amino acid content, combined with (2) increased homocysteine remethylation.

High quality proteins such as egg white protein, particularly owing to their methionine and cysteine content, represents an excellent food source with respect to management of homocysteine. Moreover, whole eggs are the primary source of choline in the American diet, and as mentioned, choline can be oxidized to betaine which in turn serves as a source of methyl groups to remethylate homocysteine and provide methyl group supply as SAM. Therefore, eggs optimize methyl group and homocysteine metabolism from multiple nutritional avenues. ✹

Messages

- When a dietary protein has a cysteine concentration in balance with methionine, the need to utilize methionine for its synthesis is reduced. This is often referred to as the methionine-sparing effect of cysteine.
- High quality proteins such as egg white protein, particularly owing to their methionine and cysteine content, represents an excellent food source with respect to management of homocysteine.

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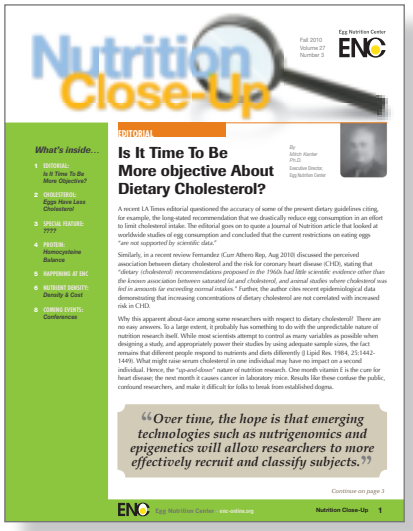
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Keeping Your Eggs Healthy.

In recognition of the recent salmonella outbreak that led to the recall of eggs in many parts of the country this summer, America's egg farmers issued a statement urging consumers to thoroughly cook their eggs. Eggs should be cooked until the whites and yolks are firm or, for dishes containing eggs, until an internal temperature of 160 degrees Fahrenheit is reached. Thoroughly cooked eggs are thoroughly safe eggs, according to the Center for Disease Control (CDC) and the Food and Drug Administration (FDA).

In addition to thorough cooking, other safe food-handling practices include the following simple steps:

- Thoroughly clean your hands, as well as the surfaces and utensils that come into contact with raw eggs - an important step for avoiding cross-contamination.
- Separate eggs from other foods in your grocery cart, grocery bags and in the refrigerator to prevent cross-contamination.
- Keep eggs in the main section of the refrigerator at a temperature between 33 and 40 degrees Fahrenheit, and eggs accidentally left at room temperature should be discarded after two hours, or one hour in warm weather.

For more information and recommended handling, cooking and storage guidelines, visit: www.fightbac.org or www.eggsafety.org. ✹