**Invited Commentary**

**Impact of phytosterols on mitochondrial functions**

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Phytosterols are structurally related to cholesterol and are mainly C28 and C29 carbon steroid alcohols. Plant sterols, also named phytosterols, are integral components of the membrane lipid bilayer of plant cells. Unlike animal systems in which cholesterol is most often the single final product of sterol synthesis, each plant species has its own characteristic distribution of phytosterols, with the three most common phytosterols in nature being β-sitosterol, campesterol and stigmasterol. In addition to the free sterol form, phytosterols are also found in the form of conjugates, particularly fatty acyl sterol esters.

In humans, phytosterol absorption is considerably less than that of cholesterol. Some investigations support that phytosterols decrease cholesterol absorption and, thus reduce circulating concentrations of cholesterol. Indeed, in the intestine, phytosterols compete with cholesterol, leading to reduced cholesterol absorption and, as a consequence, to a lower plasma LDL-cholesterol concentration. In addition, phytosterols appear not only to play an important role in the regulation of CVD but also to exhibit anti-cancer properties.

The major currently identified and well-recognized side effects associated with the consumption of phytosterols are that they reduce plasma LDL-cholesterol concentration. In addition, plant sterols decrease cholesterol absorption, and thus reduce circulating concentrations of plasma cholesterol. Indeed, in the intestine, phytosterols compete with cholesterol, leading to reduced cholesterol absorption and, as a consequence, to a lower plasma LDL-cholesterol concentration. In addition, phytosterols appear not only to play an important role in the regulation of CVD but also to exhibit anti-cancer properties.

The lower plasma cholesterol concentrations observed with plant sterols compared to those observed with cholesterol are attributable to the mechanism of action of the former. Indeed, plant sterols reduce the absorption of cholesterol from the intestine, which leads to a reduction in the synthesis of cholesterol in the liver, and thus, to a decrease in plasma cholesterol concentrations. Moreover, phytosterols can alter the composition of the plasma phospholipid membrane, which may affect the function of the liver and other organs.

In summary, the consumption of phytosterols appears to be a safe and effective way to lower plasma cholesterol concentrations and, therefore, to reduce the risk of CVD. Further research is needed to better understand the mechanisms by which phytosterols reduce cholesterol absorption and to evaluate their long-term effects on health.
suggest that phytosterols more efficiently target mitochondria than plasma membrane integrity, a possibility that cannot be excluded.

Thus, based on currently published data obtained by different laboratories, there is some evidence that mitochondria could be a potential direct or indirect target of phytosterols, and that these can trigger some mitochondrial dysfunctions even at concentrations considered effective for cholesterol lowering. Therefore, as mitochondria are a major cellular organelle involved in energy production, glucose and lipid metabolism, it is important to identify, in a metabolic context, the impact of phytosterols on this organelle in terms of ATP production and fatty acid β-oxidation, especially in subjects regularly eating and/or drinking ‘functional foods’ supplemented with phytosterols.

Gérard Lizard
Centre de Recherche INSERM 866
Lipids Nutrition Cancer
Equipe Biochimie Météabolique et Nutritionnelle
Faculté des Sciences Gabriel
Université de Bourgogne
6 Boulevard Gabriel
21000 Dijon
France
email gerard.lizard@u-bourgogne.fr

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