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LETTER TO THE EDITOR

Beta-glucan may play an important role in algae hypocholesterolemia effect

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Hypercholesterolemia features an increased LDL-C, TG and decreased HDL-C and is considered to be the reason for the heart disease and associated deaths. Statin is very effective in lowering VLDL-C but has no effect on TG and HDL-C. Statin also has some severe side effects in the treatment of hypercholesterolemia including liver damage, renal dysfunction, and myopathy [1]. Thus, functional food is sought for assisting such treatment, in hope to reduce the dose of statin for the treatment which in turn reduces the side-effects. Oat was reported to have the effect of inducing hypocholesterolemia in 1963 and the active compound was identified to be beta-glucans [10]. Recently, mushroom was also found to have such an effect although beta-glucans derived from mushroom were originally identified to have the effect of stimulating immune system. Similarly, oat beta-glucan has also been shown to be able to stimulate immune system. Several mechanisms for beta-glucans to induce hypocholesterolemia have been revealed [4]. The major one is that they can bind to bile acids which facilitate the exclusion of bile acids and thus to increase the conversion of cholesterol into bile acids. It also decreases the absorption of cholesterol. In addition to oat and mushroom, other functional foods such as algae have also been shown to have hypocholesterolemia effect. However, the mechanism is less clear. The paper "Hypocholesterolemic effect of Nostoc commune var. sphaeroides Kützing, an edible blue–green alga" in your journal further explored the mechanism and identified that the decreased cholesterol absorption is a major mechanism [7]. However, the component responsible for such an effect is unknown. We think that beta-glucan in algae may play an important role. Thus, there is possibility that algae beta-glucan has similar effect as oat beta-glucan.

The beta-glucans in several algae including *Prototheca zopfii, Chorella pyrenoidosa, Caulerpa simpliciuscula* have been identified [3, 8, 9]. These beta-glucans are characterized by 1,2 link 1,3 and 1,4 linkages. However, the effects of these beta-glucans on blood cholesterol have not been studied. The results in the Rasmussen's paper showed that LDLR, CYP7A1 mRNA (but not protein) and HMGCoAR were increased. These changes may be via decreased blood cholesterol either due to a decreased synthesis or an increased conversion of cholesterol into bile acids. The increase of CYP7A1 mRNA may represent an increase in the conversion of cholesterol into bile acids. However, the changes of bile acids in faeces were not detected. This may be explained by the effect of the intestinal bacteria on bile acids. Thus, the model of ileostomy is used for the accurate measurement of bile acids changes [2, 5]. Further evaluation of the change of cholesterol into bile acids may be needed. For example, the production of CYP7A1 7a-hydroxy-4-cholesten-3-one could be examined.

In addition, the decreased cholesterol absorption may also be influenced by a low-energy intake due to a high-satiety effect produced by beta-glucans. Recently, beta-glucans have been shown to increase satiety [6]. This may also contribute decreased intake of cholesterol.

All together, beta-glucan may be the major component responsible for the hypocholesterol effect of algae although other components could not be excluded to this effect. Thus, it will be interesting to further identify the role of

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beta-glucan in the blue–green algae and associated mechanisms for lowering blood cholesterol level.

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