Correspondence

Reassessing the Role of Sugar in the Etiology of Heart Disease

I have two comments concerning Dr. Grant's article Reassessing the *Role of Sugar in the Etiology of Heart Disease* in the *Journal of Orthomolecular Medicine* (1998; 13/2: 95-104):

1. Although Dr. Grant hints at the fact that sucrose becomes a precursor to triglycerides more so than glucose, this fact is clearly if not unequivocally demonstrated by the experiments by Winitz, Seedman and Graff[1] regarding chemically defined diets in which pure glucose (not starch) at 88% of total calories (TC) was found to lower total cholesterol while 25% glucose-replacing sucrose (equivalent to 11% TC fructose) was found to raise total cholesterol.

2. The two parameters for heart disease considered are fats and sweeteners which are, as indicated, macronutrients. Dr. Grant however does not elaborate on the hypothesis that it may, in fact, not be these macronutrients themselves that are causally related to the observed statistical (or factual) link to infarction and CHD but that the causal link may be the absence of micro nutrients in fats and sweeteners. I would suggest that fats and sweeteners have always been consumed in some amount but that the processing and refining of these macronutrients are new to the human diet, and that more likely the resulting lack of phytochemicals, vitamins and minerals are the main causal pathway to heart and vascular diseases. In other words, I feel that there was a misplaced emphasis in the literature on macronutrients (fats, sweeteners) while the real music is being played (in the Boehringer Mannheim and the like chemo-biological pathways) by the lack of accompanying micronutrients.

Regardless of the chemical musicians and resulting music, i.e. health effects, the light show and the money remain in the fat and cholesterol departments. It is urgent to determine through clinical and population studies if a lack of micro-nutrients rather than an excess of some selected macronutrients is the true cause of vascular diseases.

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Dr. Grant Replies

First, let me thank Mr. Vos for pointing out some problems with my paper in the June 1998 issue of JOM.[1] I fully agree that fructose is the portion of "sweeteners" implicated in the etiology of ischemic heart disease (IHD). Fructose is more lipogenic than glucose of starches, and usually causes greater elevations in TGs and sometimes in cholesterol than other carbohydrates.[2]

However, I am in only partial agreement with his point that fats and sweeteners may not be causally related to IHD but, instead, the absence of essential micronutrients in fats and sweeteners.

I consider the current obsession with dietary fat in the etiology of IHD to be misguided and primarily derived from Ancel Keys' work.[5,6] For the 22 countries with readily available coronary heart disease (CHD) mortality rates and dietary information, animal protein had a higher risk factor for CHD than did animal fat.[7] Keys was incorrect to choose only 7 countries from that set for further studies. What Keys and others since have tended to overlook is that excess dietary sugars such as fructose are stored as triglycerides (TGs) and incorporated into the very low density lipoprotein cholesterol (VLDL-C), both of which are now considered high-risk factors

for IHD. Glucose, on the other hand, is controlled by insulin, and is used more directly for energy.

My additional research on the topic started with seeking to understand the role of homocysteine (Hcy) in CHD, as well as the role of wine. Kilmer McCully[8] makes an impressive case for the involvement of Hcy in the etiology of CHD. Hcy is derived from methionine, an amino acid more common in animal proteins than in vegetable proteins. In adding animal protein to the statistical analysis, I soon found that milk protein had a stronger association than did total animal protein.[3] However, going further, I found that lactose had a much higher statistical association than did milk protein. In this, I reproduced the results of others before me.[9-12] Note that fermented milk products, such as cheese and yogurt, are low in lactose.

In addition, I read up on the "French paradox," (i.e., that the French, with 42% of their calories from fat, have much lower IHD mortality rates than do northern Europeans).[12] One hypothesis is that wine, especially red wine, reduces the oxidation of VLDL- and LDL-C, thereby reducing the risk for IHD.[13] However, it is also arguable that the low IHD mortality rate in France is associated with their low consumption of unfermented milk.[10-12] By analogy with fructose, lactose must lead to the formation of TGs and VLDL-C.

Whereas postmenopausal women, like men of all ages, are most at risk of IHD from lactose, premenopausal women still have the highest risk for IHD from sweeteners.[1,3] This is likely due to the protective effects of estrogen and other physiological adaptations to childbearing and lactation.[3]

Now, what about the role of Hcy? A careful reading of the literature finds that groups with high levels of Hcy also have high levels of TGs.[14,15] One of the effects of Hcy is to increase the formation of oxycholesterols and other oxidized lipids during the modification of LDL in the pres-

ence of cupric or ferric ions.[16] Lipid oxidation is now seen as very important in atherogenesis.[17]

The hypothesis which can be derived from the literature discussed here is as follows: the sugars fructose and lactose, through metabolism into TGs and incorporation into VLDL-C, followed by oxidation, present the highest dietary risk for IHD. The primary ways to reduce the risk of IHD are first, to reduce consumption of fructose, lactose, and sucrose (a combination of fructose and glucose), second, to increase the consumption of whole grains, legumes and vegetables, which are known to reduce cholesterol,[18] and third, take dietary supplements of antioxidants including vitamins A, C, E, plus B vitamins and free radical scavengers such as selenium. The benefits of red wine can be obtained by taking grape seed extract supplements.

I wholeheartedly support Mr. Vos' call for case-control, clinical and cohort studies to more fully elucidate the role of various dietary macro- and micronutrients in the etiology of atherosclerotic heart disease.

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