Choline, Carnitine & the Heart: Is TMAO Really a Risk Factor? - Holistic Primary Care

Sunday, 17 March 2019 17:33 By Russell Jaffe, MD, Contributing Writer

Anyone who has heard me lecture knows that I recommend that everyone incorporate a simple list of detox “super-foods” as staples into their diets. I call the list “GGOBE,” as it stands for Garlic, Ginger, Onions, Brassica vegetables, and Eggs).

Recently, I was asked if I had any concerns about elevated levels of TMAO—trimethylamine N-oxide–with a diet high in eggs. This is a reasonable question given that elevated TMAO levels have been linked to increased cardiovascular disease and stroke.

As with most physiologic functions, however, the answer is nuanced and highly individualized. It’s not a simple “good or bad” subject.

When people ingest nutrients like carnitine, choline and even betaine, gut bacteria break it down to produce a compound called trimethylamine (TMA). The liver converts TMA into trimethylene N-oxide (TMAO). Beginning with a series of articles in 2013, researchers have been tracking a positive correlation between elevated plasma levels of TMAO and an increased risk for cardiovascular disease and stroke.

On face value, it seems that TMAO is a bad thing, and some clinicians and researchers had an initial knee-jerk reaction to these TMAO studies, advocating for use of antibiotic therapy to knock out the bacteria responsible for the TMA surge.

But the known drawbacks of antibiotic use and the short-lived benefits quickly made other options preferable.

The next ‘gut’ reaction has been to recommend a decreased intake of all forms of choline and carnitine to decrease TMA, and ultimately TMAO, production. Since meat, dairy and eggs are higher sources of these nutrients, the conventional go-to recommendation is to cut consumption, and of course, avoid all supplements containing choline and carnitine.

But, as I say, it is not so simple.

TMAO as a cardiovascular risk factor has now been studied in various populations: meat/egg consumers vs vegans, choline and carnitine supplement takers vs non-takers.

These subsequent studies have made clear that the TMAO blame rests on the shoulders of the gut microbiome composition more than on the consumption of choline and carnitine, or of foods containing them. When the gut bacterial composition is balanced and healthy, the conversion from TMA to TMAO does not happen.

Drilling down a bit deeper, here are additional clinically important aspects of the TMAO issue:

1. While it cannot be negated that choline and carnitine are precursors to TMA and then TMAO, trying to reduce the production of TMAO by decreasing important nutrients like choline and carnitine can be counter-productive.
2. The amount of TMA that metabolize to TMAO is not accurately predicted by the food source and is not proportional to the amount ingested.
3. While being implicated as a biomarker for cardiovascular risk, there is no evidence that elevated levels of TMAO result in elevated C- reactive protein, LDL levels, or any other

independent cardiovascular risk factors for which carnitine supplementation would actually be highly beneficial.

4. Fish and seafood are rich in TMA, however they are not implicated in increased risk of cardiovascular disease and fish oil is still recommended.
5. Cruciferous vegetables inhibit the activity of the FMO3 enzyme that plays a vital role in converting TMA to TMAO.
6. Decreasing inflammation decreases the negative effect of TMAO.
7. TMAO is still being considered a bystander and not a cause of disease

My “TMAO-free” suggestions include:

- Follow a Mediterranean/alkalinizing diet. Cold-pressed extra virgin olive oil, nuts, fruits, vegetables and fish, are helpful in adding a protein called DMB (3,3-dimethyl-1-butanol) that can inhibit TMAO production.
- Increase your intake of cruciferous vegetables (aka Brassica), an integral part of my 5 super detox foods: GGOBE
- Include sufficient amounts of prebiotics and probiotics to balance the gut microbiome . Measuring your transit time can give you a good idea of gut function.
- Use healthy, safer sources and amounts of choline citrate, L- carnitine and betaine
- Maintain adequate intake of anti- inflammatory compounds like buffered vitamin C and quercetin.

END