

TMAO

Trimethylamine Oxide by Milton Teske, MD

When we look at the blood of heart attack victims for a clue as to what might be responsible for this number one cause of death, it is not cholesterol or saturated fat or sugar that stands out. The highest correlation is found with a substance named trimethylamine oxide (TMAO). Heart attack victims have high levels of TMAO and if you prospectively follow patients there is a direct correlation between their TMAO level and their likelihood of going on to have a heart attack and those with the highest levels of TMAO have way more heart attacks than those with lower levels.

This toxic chemical is not something that should normally be a part of healthy human blood. TMAO is made in the liver. It is in the liver that trimethylamine (TMA) is oxidized into TMAO in an attempt to destroy the TMA. So where did the TMA come from? Certain bacteria that can live in our intestines make TMA. These particular bacteria can metabolize creatine in our food into TMA, which is then absorbed into the blood that then goes to the liver that tries to get rid of it by oxidizing it into TMAO.

Creatine metabolism in the gut

Creatine is a substance that our bodies normally make and use as a fast energy source for the mitochondria particularly in our muscles. In the diet it is found in high concentrations in red meat (the cow's muscle). When we eat red meat these particular bacteria in our gut metabolize the creatine in the meat into TMA, which we then absorb. And so begins this toxic chain reaction eventually leading to a heart attack.

After eating a steak we can watch the blood and see an immediate spike as the TMAO level shoots up. And we know it is due to these certain bacteria in the gut because we can wipe them out with a short course of antibiotics and then feed a steak and there is no TMAO produced at all. But after a few weeks when the bacteria have been allowed to recolonize the gut eating a steak will again cause the production of TMAO.

Interestingly, we can feed that same steak to a vegan and surprisingly there is no TMAO produced! Apparently when we live on an exclusively plant based diet our gut is full of vegan bacteria that are feeding on fiber and plants. Those steak eating bacteria that metabolize creatine have been starved out and are not there – so no TMAO will be produced from an occasional dose of creatine.

Besides red meat, today we find creatine being added to energy drinks and certain athletic supplements because of its role in rapid energy production – but when tested we find the same results, regular use will result in the production of TAMO. These supplements should be avoided.

Choline

There has been a popular health fad in recent years to reduce red meat consumption. And this is usually done by substituting chicken, turkey or fish for red meat in the diet. While we avoid the creatine found in the red meat by doing this we are no better off for white meat is full of choline. Choline is a substance found in very high amounts in the white meats as well as dairy products and eggs. Chemically the structure of choline is very similar to the creatine found in red meats and the same bacteria that transform creatine into TMA transform choline into TMA. So the results are the same – you can substitute a couple of hard-boiled eggs for your steak and the TMAO levels in the blood go up just the same.

Incidentally we use choline in our bodies in a number of ways – and our bodies makes all the choline we need so we don't need it in our diet feeding a population of harmful microbes that we would be better off without.

Atherosclerosis

TAMO is a very inflammatory substance and apparently is a key aggravator of the inflammatory response in the artery walls where the macrophages turn into large fat filled foam cells and we actually build up little pustules under the endothelium. It's sort of like arterial wall acne. This is the disease that will progress to rupture and clot formation and heart attack or stroke.

Many researchers now believe that TAMO production is the underlying reason that atherosclerotic heart disease is consistently correlated with diets high in meat eggs and

dairy products. And this would explain why plant based diets free of animal products are consistently correlated with reduction of atherosclerotic disease.

Cancer

Diets high in meat, dairy and eggs are also consistently correlated with cancer – and researchers are also seeing the role of TMAO as key in this disease process as well. The inflammatory action of this toxic substance apparently signals the transformation of the cell to a more uncontrolled reproduction and spreading state that overrides the normal restraints built into the cells of the various organs and tissues of the body.

Take prostate cancer as an example. The benign early stages of prostate cancer are no problem until they start to spread and metastasize throughout the body. A lot of study has been done to try to locate the risk factors that cause some to make this deadly transformation and others to remain benign for years and decades. What did they find? Eggs seem to be the big dietary risk factor – and they think it is the choline. Even as little as one egg every 3 days is enough to double the risk of cancer progression. The only higher risk factor than eggs was eating chicken.

Your microbiome

The microbiome refers to the multitude of single cell life forms that live on and in us. Most of them live inside our gastrointestinal tract and we are only beginning to understand their importance to our health. They are intimately a part of us and we could not survive without them. In terms of numbers they outnumber our human cells ten to one! Although they vastly outnumber our human

cells, yet because of their very small size they make up only about 2 quarts of our total volume. But if you start thinking about genetics – these each have their own genetic code – our human genome makes up a minute fraction of the different DNA codes found in us and influencing and controlling the various biological and biochemical processes going on inside us. There are over 10,000 different species of microbes living in us. Some estimates place that number as high as 35,000 - each of these with their own DNA. For every human gene in your DNA there are hundreds of non-human genes present and being expressed and carrying out their unique contribution to the totality of life activities going on inside of us.

We now realize that these microbes communicate and have controlling influences over most organs in our bodies. They participate in a wide variety of physiological functions including our immune system where they play a very major role. They are involved in detoxification, inflammation, vitamin production, nutrient absorption, signaling our appetite center, utilization of carbohydrates, fats and other nutrients. They make neurotransmitters and send signals to our brain and can affect our mood and emotional state, the clarity of our thoughts, our energy level and our perception of the world. How we feel emotionally and physically really depends on the state of our microbiome – Is it healthy and dominated by friendly, beneficial bacteria? Or is it sick and overrun by bad, unfriendly and even pathological microbes?

We are all populated by vastly different microbial communities, which to a large degree determine the state of our health or sickness. So how can we get good, healthy,

friendly bacteria to live in us and get rid of the bad ones? There are many probiotic supplements available on the market, many containing a dozen or two of some of the most common healthy bacteria species. This can help to make a good start at re-colonization of the gut if you have destroyed your healthy bacteria with antibiotics or other medications or bad foods. But far more important than probiotics is what you feed your microbes!

Remember there are over 10,000 different bacteria needed in your microbiome and the ones you feed are the ones that will grow and live and the ones you don't feed will die off. It is now becoming abundantly clear that a high fiber whole plant food diet is the perfect diet to grow and maintain a healthy microbiome in your gut. Animal foods and junk foods feed different populations of bacteria and thus promote serious disruptions and pathological imbalances in the populations of bacteria that inhabit your gut. If you want the right species of bacteria living in you and influencing your life you have to feed them the right foods – whole plant foods.

So as we have seen in our study of TAMO at the beginning of this article – the major cause of death in our country today all comes down to feeding the right bacteria in our microbiome with the right food. Perhaps as we continue to understand more deeply the great complexities of the web of life God has created with all of its interconnecting dependencies we may find that proper nutrition is not so much about which nutrients our bodies need but rather which nutrients the microbiome living within us needs.

At the creation of this world God looked at all that He had made and behold it was very good and then He told man what was to be his food and then He described exactly what the microbiome living within him needed to keep him healthy. May we continue to respect the divine wisdom of our Creator by obeying His instructions.



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