Image Awareness Wellness Institute

The Good, The Bad and the Ugly

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Introduction

After the title for this newsletter occurred to me I found that the concept was not original. I discovered a blog from Harvard University titled "Protein Misfolding: The Good, the Bad, and the Ugly." The blog discussed recent research on misfolded protein. I will include that but desire to approach the discussion of protein from a wider perspective.

One of the earliest suggestions that damaged proteins could be detrimental to health was proposed by Dr. Francis M. Pottenger, Jr. Pottenger conducted a ten year study of cats in which they were fed raw or heated protein foods. Animals given heated milk or cooked meat deteriorated physically.

Cats given heated protein foods developed inflammed gums, calcium deposits on the teeth, irregular teeth, and changes in facial structure. They also developed immune deficiencies, runny noses and fevers, allergies, asthma, glandular, nervous, and bone problems. Animals eating heated proteins were not able to reproduce beyond three generations.

Pottenger concluded one of his papers on the experiment as follows: "What vital elements were destroyed in the heat processing of the foods fed the cats? The precise factors are not known. Ordinary cooking precipitates proteins, rendering them less easily digested. Probably certain albumin-oids and globulins are physiologically destroyed. All tissue enzymes are heat labile and would be materially reduced or destroyed... *It is our impression that the denaturing of proteins by heat is one factor responsible*."

There are three readily observable changes in protein which take place with the application of heat.

Water Loving to Water Fearing

The first change observed in some proteins is the conversion from a water loving (hydrophylic) form to a water fearing form (hydrophobic). An illustration is the cooking of an egg. A raw egg can be blended in fluid, while this is not easily done with a cooked egg.

Pottenger felt that water loving proteins were easier to digest and could actually aid the digestive process. Today we know that when the body builds proteins they must be folded into specific shapes to function properly. This folding is built around the use of water loving and water fearing proteins. It is possible that even low temperature cooking of proteins may impact this process.

The Browning Effect

When proteins are heated in the presence of sugars, the sugars bond to the amino acid lysine creating what is called the Maillard reaction or the browning effect. The body can not use protein that has been altered in this way and it is not healthy.

Browned protein is common in breakfast cereals like corn flakes and granolas which are highly heated. Browned protein is also present in crackers and the crust of breads. There is very little browned protein in oatmeal and muesli.

Black Protein

When very high temperatures are applied to proteins they tend to turn black. The black color signifies the presence of polycyclic aromatic hydrocarbons which are often mutagenic and carcinogenic.

High temperatures and dry heat promote the formation of these toxic proteins. Denaturing of protein is minimized with low temperature cooking with moist heat for shorter periods of time. The addition of lemon juice or vinegar to proteins in the cooking process also minimizes damage to the protein.

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Cornflakes: By GeoTrinity - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=49838802

The Milk Story

Pottenger found that even pasteurized milk led to deterioration in the health of animals. It is worth noting that when pasteurization was first introduced a number of court cases took place in which many professionals who worked with children noted that raw milk was generally much healthier for children than was pasteurized milk.

Douglas shares the following comments from one of the court cases: "In addition to the professional evidence offered, the relators offered the testimony of a number of mothers and other raisers of children, and they uniformly testified that children who were not healthful when fed on pasteurized milk were healthful when fed raw milk."

Pasteurization virtually eliminated tuberculosis and brucillosis epidemics from consuming contaminated milk when it became mandatory in 1947. It also eliminated one of the last readily available and consumable sources of unheated protein in the American diet and may be responsible for some of the physical deterioration readily observable in the human population.

The process of pasteurization has not remained the same as it was when introduced. In the search for increased shelf life new processes have been introduced. Traditionally pasteurized milk has a shelf life of 2-3 weeks, ultra-pasteurized milk will last 2-3 months, and ultra-heat treatment milk (UHT) will last up to 9 months.

One wonders how nutritious a food can be if bacteria can not feed on it for such a long period of time. One of the early nutrition pioneers noted that if a food will not nourish bugs why would we think that it was a desirable food for a child to consume.

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Milk: By Stefan Kühn - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=23754

Sugar Damage to Protein

As previously described, sugars can interact with protein and this is true both outside the body and within. The combination of a sugar with protein is called glycation. The interaction results in toxic byproducts called AGE's (advanced glycation endproducts).

Both glucose and fructose can combine with protein. The attachment of sugars to misfolded proteins is a prominent feature of neurodegenerative diseases like Alzheimer's and Parkinson's. AGE's are also implicated in heart disease and diabetes.

Sugars Within the Body

Diabetes is a medical condition in which sugar-protein interactions play a prominent place. Adult onset or Type 2 diabetes is most frequently associated with excessive consumption of sugars.

Reducing blood sugars is a prominent aspect of treating diabetes. The elevation of blood sugars is measured by testing for Hemoglobin A1C or glycated hemoglobin. This is a measure of how much sugar has attached to the protein hemoglobin in red blood cells. Much of the physical deterioration diabetics experience is associated with the interaction between sugars and protein structures in the kidney, circulatory system, nerves, and eyes.

AGE's Ingested with Foods

Scientists are suggesting not only a reduction in the ingestion of sugars, but also reducing the intake of AGE's. This is done by avoiding cooking with dry heat and high temperatures which can increase AGE's in foods by up to 100-fold. Fried bacon has one of the highest contents of AGE's of any food.

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Bacon: By Renee Comet (Photographer) - This image was released by the National Cancer Institute, an agency part of the National Institutes of Health, with the ID 2686 (image) (next)., Public Domain, https://commons.wikimedia.org/w/index.php?curid=24036670

The EMS Story

In 1989 an epidemic of a disease called EMS or eosinophilia-myalgia syndrome appeared out of nowhere. A number of people died. Researchers traced the disease to a form of the amino acid tryptophan imported from Japan. The genetically modified amino acid proved to be toxic. This

should have served as a warning that slight modifications of amino acids or substances similar to nutritionally essential amino acids could prove to have powerful toxic properties.

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The BMAA Story

After World War II army physicians on Guam encountered an epidemic of lytico-bodig syndrome (lytico= paralysis and bodig = dementia). The syndrome looked very much like ALS (Lou Gehrig's disease) but also had elements of Parkinson's and Alzheimer's.

Neurologist Leonard Kurland traced the highest outbreak to a village on Guam's southern coast. Later researchers traced the outbreak to cycads, primitive palm-like plants. The people were grinding the seeds of the plants into the flour they used to make tortillas.

In the 1960's researchers honed in on a substance called BMAA, found in cycads, which was similar in structure to a known toxin found in Asian chickpeas that caused a paralyzing disease. Research soon showed that BMAA killed motor neurons as found in ALS or Lou Gehrig's disease..

The problem researchers dealt with was that it took high concentrations of BMAA to kill neurons--more than was present in the cycad seeds. Subsequent research revealed two new facets of the problem.

Biomagnification

Firstly, it was learned that the people of Guam had been consuming fox bats that fed on the cycad seeds. They proved to be bioaccumulating the toxin in their bodies. This showed that toxic nonprotein amino acids could biomagnify as they travel up the food chain in the same manner that mercury accumulates in large fish like tuna when they eat large numbers of smaller fish contaminated with mercury.

Substitution and Misfolded Protein

Secondly, researchers learned that BMAA produced its toxic effect by displacing the natural amino acid serine in neurons causing the proteins to fold improperly which was killing the neurons. High intake of the amino acid serine appeared to be protective against the toxin.

Cyanobacteria

Finally, researchers learned that BMAA was not produced by the Cycad plants, but by cyanobacteria which lived with the plants in a symbiotic relationship.

This changed everything. Cycad plants are not common, but cyanobacteria or blue-green algae are everywhere. They are common contaminants of water in lakes and rivers, especially when fertilizers make their way into bodies of water.

Sea foods, particularly shellfish, growing in waters contaminated with cyanobacteria have been found to be contaminated with BMAA and other algae toxins. The contamination problem has been particularly acute in Florida and many researchers will not consume fish from the state.

Neurodegeneration

Researchers have now found that there are clusters of ALS in proximity to waters contaminated with blue green algae.

Research has shown that BMAA produces lesions in nervous tissue identical to what is found not only in ALS, but also lesions characteristic of Parkinson's, and Alzheimer's.

The antidote to BMAA appears to be the natural amino acid serine. An abundance of the natural amino acid prevents BMAA, a toxic mimic of serine, from becoming incorporated into neurons.

Some researchers have suggested that BMAA may be more toxic when consumed in water or when it is dispersed in the air since there is no serine present to counteract the toxicity. These bacteria have been found not only in lakes and rivers, but also in air conditioning systems of large buildings and swamp coolers.

BMAA in Health Foods

Aquatic toxicologist Wayne Carmichael concluded the following with regard to supplementaiton with spirulina in an article in Scientific American in 1994: "Because cyanobacteria are often collected simply from the surface of an open body of water and because neither sellers nor buyers can distinguish toxic from nontoxic strains without applying sophisticated biochemical tests, the safety of these items is questionable."

Carmichael noted in this article that some varieties of cyanobacteria produce both neurotoxins and liver carcinogens. I have warned people about consuming products with spirulina since this article first appeared almost a quarter century ago. I remember people asking toxicologist Dr. Arthur Furst if NeoLife would come out with a product with spirulina. He repeatedly stated that NeoLife would never

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come out with such a product due to toxicological concerns.

Rodgers and associates write, "Other things being equal, a low-protein diet will increase susceptibility to the adverse effects of proteomimetic amino acids, and conversely a high protein (and proteomimetic amino acid-free) diet will be protective."

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Cyanobacteria: By Jacques Le Letty - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=29448464

ONLY THE BEGINNING

The misfolding of protein and its disastrous consequences is highlighted by the story of BMAA. Unfortunately, there are other nonprotein amino acids known to contribute to misfolded protein and toxicity.

A substance called AZE (azetidine-2-carboxylic acid) has been found in beets. It displaces the amino acid proline in proteins causing misfolding which is associated with the development of *multiple sclerosis*.

There is also a nonprotein amino acid in alfalfa sprouts called L-canavanine which can induce *SLE (systemic lupus erethematosis)* in monkeys.

It turns out that many plants produce nonprotein amino acids of lesser or greater toxicity as protective mechanisms to protect them from being consumed by microbes and insects. Research into these substances is only beginning.

Nash and associates point out that many plants containing toxic proteins are used in animal feeds. They are also found in herbal medicines. They observe that "The increased interest in herbal medicines in the Western countries will increase exposure to such compounds."

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