Food Allergies, Intolerances and Sensitivities: A Link to Biotoxin Illnesses

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Background

Approximately 15-20% of adults have a food intolerances or sensitivity.[1] These patients report a wide range of symptoms, including gastrointestinal distress including abdominal pain, gas/belching/burping, IBDs (like IBS, Crohn's, ulcerative colitis), peptic ulcer, migraines, chronic fatigue, arthritis, rashes, respiratory distress, skin issues, weight gain, increased illnesses/immune/autoimmune imbalances, and chronic pain issues.[2,3] Of interest to this article, biotoxin illnesses are also linked to chronic inflammation – metaflammation - that results from AND contributes to food sensitivities/intolerances.[4]

Current literature supports the fact that food allergies, intolerances and sensitivities are directly tied to metainflammatory sequelae and the release of GUT mucosal IgE and IgG type antibodies.[5,6,7] One of the main culprits of metainflammatory signaling is the GUT, leading to mucosal integrity and microbiome issues.[8] Food allergies/sensitivities and intolerances upregulate not only IgG, IgG4 and IgE response but also C3b and C3d complement response. This contributes to the already upregulated complement expression in biotoxin and Lyme diseases. As a result, removing reactive foods can help to reduce total global burden of inflammatory compounds and support recovery from biotoxin illness.

An altered microbiome is not only a marker of disease but also actively contributes to multiple disease pathogenesis.[9,10]

Biotoxin Illnesses and the GUT

Biotoxin illnesses include Lyme and CIRS, with both leading to immune dysregulation via GUT-Immune and GUT-Brain axes disruption and resulting metainflammatory sequelae. Studies suggest a major role for the gut microbiome in the development of biotoxin illnesses.[11] Disturbances in the GUT microbiome and epithelial function contribute greatly to chronic inflammatory sequelae through the release of endotoxin (lipopolysaccharide or LPS) and the upregulation of inflammatory cytokines.

Biotoxin illnesses can result from exposure to:

- Mold illness - Inhalation of mold, bacteria and inflammagens that create a biochemical "stew" in water damaged buildings.
    - It has been estimated that 80% of CIRS cases are caused by repeated exposure to water-damaged buildings aka "sick building syndrome."
- Tick bite

    - Lyme and related infections are a multisystemic disease and can be found in multiple organ systems, including GI, cardiac/pulmonary, musculoskeletal, neurological, neuropsychiatric, and reproductive issues.
- Spider bite
    - The bite of the Recluse spider (especially the Brown Recluse in the US) species may also cause biotoxin illness.
- Ingestion
    - Individuals who have eaten reef fish contaminated with dinoflagellate algae (that produces *Ciguatera* toxin) may develop an illness. Exposure to the *Ciguatera* toxin occurs when eating reef fish that have eaten smaller fish that consumed the toxin producing dinoflagellate.
- Direct contact with contaminated water
    - Individuals may be exposed through direct contact with water contaminated by toxins in areas of fish kills such as *Pfiesteria* and *Cyanobacteria*, including inhalation of airborne or aerosolized toxins from this source.

Chronic Inflammatory Response Syndrome (CIRS) describes a group of symptoms, lab results, and targeted test results associated with biotoxin exposure of mold, especially in genetically susceptible people. Most of what we know about biotoxin illness is the result of practice-based studies, with research dating back to 1997.

Molds are fungi that grow best in warm, damp, and humid conditions, and there are tens of thousands of species that spread and reproduce by making spores – spores which can survive the harshest environmental conditions. According to the Centers for Disease Control (CDC), the most common indoor molds are of the *Cladosporium*, *Penicillium*, *Alternaria*, and *Aspergillus* genera.[12] In general, any area with a relative humidity of greater than 80% in the presence of metabolizable organic materials supports their growth. A relative humidity more than 90% is ideal for proliferation.

The Primary Indicators of Dampness and Microbial Growth[13]

- **Condensation on surfaces or in structures such as windows**
- **Visible mold, especially black mold**
- **Perceived moldy odor**
- **Poorly maintained air conditioning systems**
- **A history of water damage (exterior leaks, wet basement, leaking plumbing)**

Like CIRS, symptoms encountered from Lyme related illness are fueled by a dysregulated immune system and overproduction of pro-inflammatory cytokines, both as a result of GUT inflammation and microbiome disruption. Lyme disease is a condition spread through the bite of a tick carrying the *Borrelia burgdorferi* bacteria, and rarely, *Borrelia mayonii*.[14] Ticks get the bacteria through biting infected animals, such as deer or mice, and they can then spread the bacteria to humans through biting them as well. In the Eastern USA, it is often a deer tick that spreads the disease, and in the West, it's often the western blacklegged tick. The longer the tick is attached, the greater the risk of disease transmission.

Figures 1 and 2 below show the way biotoxins affect an individual who is and who is not genetically susceptible to biotoxin illness. However, keep in mind that chronic health conditions and other environmental exposures such as heavy metals or POPs (persistent organic pollutants) can impact immunity and lead to even non-genetically susceptible individuals to become susceptible.

- Age is a factor for biotoxin susceptibility
- Genetic susceptibility
    - According to studies, the more Protein glycoprotein-reducing variations an individual has in their ABCB1 gene, the more likely they are to suffer from chronic inflammatory response syndrome from Lyme after an acute *Borrelia* infection [R].
    - Those who carry a specific gene called the HLA-DR gene, can have difficulty recovering from mold and other toxin exposures including Lyme. These individuals are also more prone to gluten intolerance and increased autoimmune risk due to food reactivity.

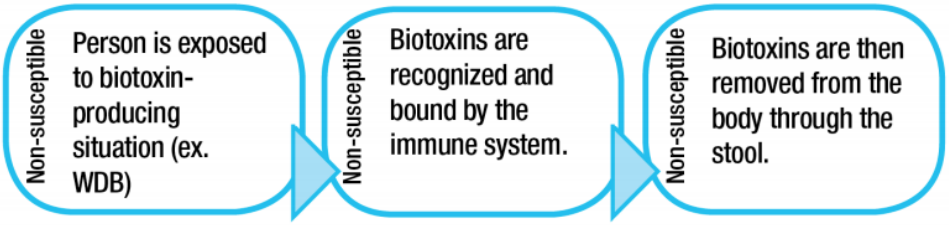

Figure 1. Actions of biotoxins in the body of a non-genetically-susceptible person

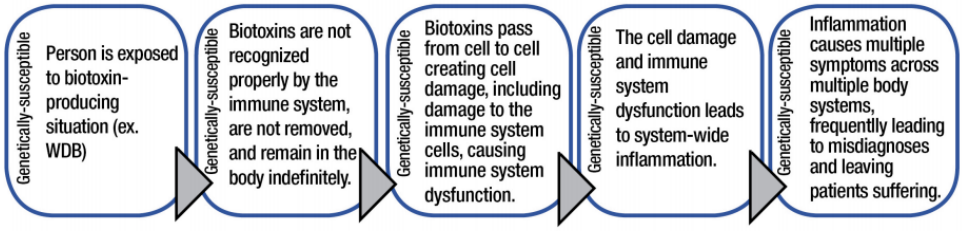

Figure 2. Actions of biotoxins in the body of a genetically-susceptible person

Symptoms that both mold (CIRS) and Lyme Disease share in humans include:

- Respiratory – Shortness of breath, cough, sinus issues, allergies
- GUT – dysbiosis, abdominal pain, diarrhea/constipation, gas/bloating, belching, GI pain, metaflammation
- Musculoskeletal – aches, pains, cramps, loss of mobility, metaflammation
- Brain – numbness/tingling, dizziness, tremors, headaches, blurred vision, confusion, lack of focus, memory issues/word recollection, mood swings, depression, anxiety, metaflammation (microglial upregulation/inflammation)
- Immune – increased colds/flu, illnesses, immune dysregulation, metaflammation
- General – **food allergies/sensitivities/intolerances**, sweating, fatigue, increased temp, appetite swings/cravings, skin sensitivity, increased thirst/urination, static shocks,

metallic taste

Labs commonly encountered with biotoxin illnesses and that should be addressed include:

- HLA DR (relative risk = susceptibility)
- MARCoNS nasal swab
- MSH (melanocyte stimulating hormone - regulatory neuropeptide)
- C3a and C4a (complement)
- MMP9 (only reliable way to measure Th1)
- ADH/osmolality (loss of feedback)
- ACTH/cortisol (loss of feedback)
- TGF-Beta 1 (transforming growth factor-beta 1)
- VIP (vasoactive intestinal peptide)
- VEGF (vascular endothelial growth factor)
- Antigliadin ab/Anticardiolipin ab
- Low VEGF (vascular endothelial growth factor)
- Elevated cytokines (TNF-alpha, IL-1B, PAI-1

Food Allergies/Sensitivities (FAS) and Biotoxin Illnesses
Food allergies, sensitivities, and intolerances contribute to the uncontrolled system wide inflammation response a hallmark trait in CIRS.

Studies suggest a major role for the gut microbiome in the development of biotoxin illnesses.[15]

Patients with biotoxin illnesses generally see an increase in food related sensitivities. A study using 55 patients with symptoms of mold reported IgG titers exceeded the upper normal limits in 35% of symptomatic men and 25% symptomatic women.[16] Also in patients with Lyme disease, humans can develop a potentially fatal food allergy to red meat when exposed to alpha-gal (galactose-alpha-1,3-galactose), a sugar found in most mammalian blood.[17] Ticks can carry alpha-gal and induce immune response in bitten humans.

It has also been reported that complement C3a and C4a levels can be increased in people with Lyme disease.[18] The use of complement split measurements in the management of potentially infected tick bite patients should also take into account elevation of C4a and C3a caused by other clinically recognized illnesses, such as systemic lupus erythematosus, rheumatoid arthritis, pancreatitis and *other immune complex or inflammatory diseases*.[19]

Conclusion
Testing for IgE, IgG, Ig G4 and C3b/d complement can provide important information for clinicians when treating patients that have biotoxin illnesses including CIRS/mold and Lyme.
Recommending a diet that minimizes foods that provoke immune responses will decrease many types of inflammation and may allow for resolution of biotoxin illness symptoms.

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