

Characterization of Human Colon Tissue for Harmful Algal Bloom Exposure in Cancer and Non-Cancer Patients

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Introduction: Harmful algal blooms (HABs) are emerging not only in the Great Lakes region, but also globally. HABs release cyanotoxins, which present public health concerns and significant health risks. Cyanotoxins may enter humans through water ingestion, aerosol inhalation, or direct skin contact. We have previously demonstrated that cyanotoxins exacerbate pre-existing liver and inflammatory bowel disease in mice. However, the effects of cyanotoxin exposure in humans with colon disease and colon cancer is poorly understood.

Objectives: We sought to identify the presence of cyanobacteria in Formalin-Fixed Paraffin Embedded (FFPE) colon tissue obtained from patients residing in the Great Lakes region. We hypothesized that the levels of cyanobacteria correlate with markers of tumor severity in colon cancer.

Methods: Using an optimized extraction/purification protocol designed for FFPE samples, DNA and RNA were extracted from colon tissues of invasive adenocarcinoma (n=5) and age- and sex-matched non-adenocarcinoma controls (n=5). The presence of cyanobacteria and markers of tumor severity were determined using quantitative PCR analysis.

Results: Cyanobacteria levels were elevated in colon cancer tissues compared to non-cancer (1.0±0.27 vs 1.3±0.66), although this was not statistically significant. Interestingly, while markers of tissue remodeling were not significantly correlated with cyanobacterial load in both cancer and non-cancer samples, cyanobacterial load was negatively correlated with transforming growth factor-beta (r=-0.6121, p=0.0334) and matrix metalloprotease isoform 9 (r=-0.6272, p=0.0261) in the invasive adenocarcinoma samples.

Conclusion: Our results suggest that cyanobacteria may be increased in the setting of invasive adenocarcinoma and may impact the expression of key tissue remodeling genes within these tumors. This data agrees with clinical and experimental evidence, suggesting an association between cyanobacteria and cancer progression in other settings. The data also supports the need to investigate the potential role of cyanobacteria in colon cancer progression. Analysis of additional samples is ongoing to establish this relationship in an expanded cohort.