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Preliminary Report

Recreational exposure to microcystins during a *Microcystis aeruginosa* bloom in Bear Lake, Michigan

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Background

Evidence of adverse human health events associated with recreational exposure to cyanobacterial blooms is primarily anecdotal, but continues to accumulate. In a recent study of Florida jet-skiers, Stewart et al. (2006) found increases in some symptoms and in respiratory illnesses in people who had been jet-skiing in bloom-contaminated waters. The exposure was assessed using algal biomass, but the organisms were not identified and the presence of cyanobacterial toxins was not confirmed.

To more thoroughly address human exposures to and health outcomes from recreational exposures to cyanobacterial toxins, we designed a study to assess concentrations of these toxins in environmental and human blood samples. In addition, questionnaires were designed to assess symptoms reported before and after study subjects participated in water-related recreational activities on lakes with active, toxin-producing algal blooms.

Objective

Our objective was to assess whether we could measure microcystins in blood from people at risk for swallowing water or inhaling spray while doing water-related recreational activities (e.g., water skiing, jet skiing) on a lake during a *Microcystis aeruginosa* bloom.

Study Activities

We recruited 104 study participants from lake visitors planning to be involved in recreational activities that would generate aerosols, such as boating and using personal watercraft. Ninety-seven participants planned such activities at a lake with a *Microcystis aeruginosa* bloom (the exposed group) and 7 planned to use a nearby lake with no bloom (the

unexposed group). We analyzed the following environmental samples: water samples for water quality parameters, potential human pathogens (viruses), algal taxonomy, and microcystin concentrations; and air and human blood samples for microcystin concentrations. We interviewed study participants to collect demographic and current health symptom information.

Results

We did not detect any of the potential human pathogens in water samples. We found very low levels of microcystins (1 µg/L to 6 µg/L) in the water and in aerosol samples (<0.1 ng/m^3). Blood levels of microcystins were below the limit of detection (0.147µg/L) for all participants. At this low exposure, study participants did not report increases in symptoms following exposure to aerosols containing microcystins. At the time of this study, concentrations of microcystin within the bloom lake water were very low (<2-5 µg/L) and the microcystin concentrations in participants' plasma samples were all below the limit of detection for the ELISA test (0.147 µg/L).

Discussion and Conclusion

This study was one of several that will be done in recreational lakes with active algal blooms. A manuscript of these data and results is being prepared for publication in a special issue of the journal Marine Drugs.

Based on this initial study, we conclude that aerosols generated by recreational activities can include measurable levels of microcystins and that these aerosols are a potential source of exposure to waterborne algal toxins.

We conducted an additional study in California to further evaluate using microcystin

concentrations in blood as a biomarker of exposure. The results of that study are not yet available.

References

Stewart I, Webb PM, Schluter PJ, Fleming LE, Burns JW Jr., Gantar M, Backer LC, Shaw GR. 2006. Epidemiology of recreational exposure to freshwater cyanobacteria—an international prospective cohort study. BMC Public Health 2006, 6, 93.