Abstract

Fecal and waterborne coliform bacteria are microorganisms found in aquatic habitats that, while not always harmful, are indicators of destructive organisms, such as the parasites *Giardia lamblia* and *Cryptosporidium parvum.* Both *G. lamblia* and *C. parvum* are gastrointestinal occupants known for causing the diseases Giardiasis and Cryptosporidiosis, respectively. The aim of this research is to examine the effect of and any possible correlation between varying levels of rainfall and the concentrations of coliforms and *Giardia/Cryptosporidium* in local freshwater lakes. Previous studies have examined various factors, but few have utilized exact rainfall measurements. This study also investigates different microbes (*Salmonella, Citrobacter freundii, C. amalonaticus, Klebsiella sp.*) than compared to previous studies, which have mainly focused on *Escherichia coli* and total coliforms. These different factors may result in data that demonstrates a correlation between certain microbes, *Giardia*, and *Cryptosporidium* with rainfall levels. Factors that may also contribute to the populations of coliforms are runoff from geographical terrain, surface water sediments, and the presence of wildlife close to the lakes.

Water analysis is carried out by weekly samplings of three zones of Hydaway Lake, one zone of Opossum creek, and two zones of Library Lake. Membrane filtration is used to analyze 1 mL sample volumes of waterborne coliforms, which are incubated for 48 hours at 37 ^{o}C. To collect data for *Giardia* and *Cryptosporidium* concentration, Fisher Quik Tests (ELISA tests) are done using 525 μL of lake water. The Library Lake data may not reflect completely natural conditions because there is nearby construction, while Hydaway Lake is a much more natural setting. Hydaway Lake is also a popular swimming area for students of Liberty University, meaning the presence of *Giardia* or *Cryptosporidium* can bear immediate consequences to health among the campus population.

Present research consists of water collection two days preceding rainfall, during rainfall, and two days after rainfall. This higher frequency of collection is expected to produce a bell-curve graph indicating lower coliform and parasite levels before and after rainfall while maintaining greater levels during rainfall. Thus, the aforementioned positive correlation between rainfall measures and microbe presence will be more precisely monitored on a semi-daily basis instead of a weekly basis as previously performed. Another additional measure taken has been to stir up the sediment before obtaining the water, showing that cysts of *Giardia* and *Cryptosporidium* may be present but lurking underneath the resting surface water.

The results from this study may have an impact on public health concerns because rivers are a major source of fresh water for cities. A significant difference was note between *E. coli* populations before and after rainfall (T-Test, $p \leq 0.03$). In addition, swimming and playing in lakes or other sources of standing water is a very popular recreational activity for the average American citizen. Calculating *Giardia* and *Cryptosporidium* concentrations based on rainfall and coliform levels could be a more efficient and accurate method that may prevent harmful outbreaks of waterborne disease in the future.