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Isolation and Identification of Antibiotic Resistance in Bacterial Samples from Lake Ontario

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Isolation and Identification of Antibiotic Resistance in Bacterial Samples from Lake Ontario

Abstract
Antibiotic-resistant bacteria are an increasing public health concern and recently the Food and Drug administration has been pressured to withdraw approval of the use of subtherapeutic doses of antibiotics in livestock. In upstate New York, sewage and agricultural run-off may contain microbes that are selected for by antibiotics excreted in humans and livestock waste. Monthly water samples were collected from six different locations in Lake Ontario over the summer of 2011 to isolate and characterize antibiotic resistance in bacteria. Samples were taken from near a treated sewage outflow pipe and the mouth of the Genesee River. Water temperature and clarity were measured for each sample location. Water samples were filtered to collect bacteria and the resulting filtrate was grown on R2A medium. Gram character and resistance to five clinically relevant antibiotics (gentamicin, ampicillin, erythromycin, ciprofloxacin and sulfamethoxazole trimethoprim) was assessed.

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Abstract

Antibiotic-resistant bacteria are an increasing public health concern and recently the Food and Drug administration has been pressured to withdraw approval of the use of subtherapeutic doses of antibiotics in livestock. In upstate New York, sewage and agricultural runoff may contain microbes that are selected for by antibiotics excreted in humans and livestock waste. Monthly water samples were collected from six different locations in Lake Ontario over the summer of 2011 to isolate and characterize antibiotic resistance in bacteria. Samples were taken from near a treated sewage outflow pipe and the mouth of the Genesee River. Temperature and clarity were measured for each sampling location. Water samples were filtered to collect bacteria and the resulting filtrate was grown on R2A medium. Gram character and resistance to five clinically relevant antibiotics (gentamicin, ampicillin, erythromycin, ciprofloxacin and sulfamethoxazoletrimethoprim) was assessed.

Introduction

Antibiotics are in wide use today in human and veterinary medicine. Recently the Food and Drug Administration has been pressured to withdraw approval of the use of subtherapeutic doses of antibiotics for growth-promotion and disease prevention in livestock. Since antibiotics are not fully metabolized in the body they can be discharged into local water sources, such as the Genesee River, through agricultural runoff and municipal waste water (human). Human waste, potentially containing antibiotics, will then flow to a sewage treatment plant (STP), such as the VanLare STP in Rochester [1]. After waste is treated, it is discharged into Lake Ontario by a 10ft diameter steel pipe that runs three miles off the shoreline [2]. When antibiotics from treated sewage and agricultural waste accumulate in Lake Ontario, this selects for resistant bacteria in the water [3]. While the cleaned effluent is also monitored for E. coli, it is not known whether other infectious, potentially antibiotic resistant, bacterial species are present.

The presence of antibiotic resistant bacteria in lakes and streams is becoming a growing health concern [4]. The problem occurs when people are using the lake for recreational activities such as swimming, boating and fishing and become infected by antibiotic resistant microbes. Certain common antibiotics may no longer be effective to treat these infections.

Methods

A U.S. Coast Guard boat was used to transport researchers to 6 locations on Lake Ontario. Samples were collected three times during the summer of 2011 (June, July & August). Locations were as follows: the output of VanLare STP (3 miles from the shoreline), 0.5 miles West of this output, 0.5 miles East of this output, the mouth of the Genesee River and VanLare sewage outflow into Lake Ontario.

Water temperature and clarity were measured for each sample in June 2011. Ampicillin (A), Erythromycin (B), Gentamycin (C), Ciprofloxacin (5 U) were placed on the plate, along with a control disk, to test for antibiotic resistance.

Bacterial colonies were subcultured until pure and colony size and morphology were determined for samples collected in the months of July and August using Muller-Hinton plates. Ampicillin (10U), Ciprofloxacin (5U), Gentamycin (10U), Erythromycin (15 U) and Sulfamethoxazole (25U) antibiotic disks were placed on the plate, along with a control disk, to test for antibiotic resistance.

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Conclusions and Future Directions

Ampicillin was observed to have the highest percentage of isolates with resistance while no isolates had resistance to ciprofloxacin. No gram + cocci were isolated from either location.

This research is ongoing. Gram character and antibiotic resistance will be determined for samples collected in the months of July and August using the same five antibiotics. Bacterial isolates will also be sequenced to confirm their identities. Results will be compared to samples taken directly from the VanLare STP.