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Take Control of Your Health

Clostridium Difficile Loves Sugar and Resists Disinfectant

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STORY AT-A-GLANCE

- The Centers for Disease Control and Prevention reported that 15,000 die every year from Clostridium difficile, a bacterium that may trigger watery diarrhea, fever, dehydration and kidney failure. It is evolving to a superbug, and has adapted to sugars commonly found in a Western diet. It also produces spores capable of resisting disinfectants
- Antibiotics are what has turned this minor player, accounting for up to 3% of bacteria in normal flora, to a major health concern; when antibiotics disrupt the normal flora, harmful bacteria such as C. diff are able to thrive and spread in the environment
- Although fecal transplants are new to Western medicine, they were reportedly being used as far back as 1,700 years ago. Colonoscopies have been the most successful means of using the treatment, but they come with risks; one study compared administration using capsules or colonoscopy and found a 96.2% prevention of recurrence in both groups
- Fecal transplants should only be done by a trained team as the donor stool must be free of disease; even under investigational conditions lethal mistakes have been made
- Handwashing is the single most effective means of preventing the spread of infection and reducing your risk of needing antibiotics. Hand washing supports a strong gut microbiome, which is another means of prevention

The Centers for Disease Control and Prevention[1] calls antibiotic resistance one of the biggest public health challenges of our time. Conservative estimates find at least 2 million are infected and 23,000 die each year with antibiotic resistant bacteria. When a

germ develops the ability to withstand drugs designed to kill them, they become antibiotic-resistant[2] and are called superbugs.[3]

Antibiotic resistance happens naturally as bacteria adapt to drugs. Resistance is helped along by the inappropriate use of medications, such as antibiotics for viral infections[4] and their use in agriculture.[5,6] The World Health Organization[7] warns emerging resistance to antibiotics threatens the ability to treat common infections that may result in prolonged illness, disability and death.

Simple medical procedures may become high-risk, which means the cost of health care rises. In what researchers believed was the first national estimate[8] of the cost for treating antibiotic-resistant infections, they found a national cost of $2.2 billion in 2014, having doubled since 2002.[9]

Antibiotic resistance is a worldwide crisis[10] with the potential to threaten people at any age.[11] One bacterium known to be fatal to the elderly and sick is clostridium difficile, or C. diff. In a recent study it was reported that this[12] bacterium has become highly adapted to spreading inside hospitals, and they may have found the reason why.

Bacteria and Sugar Make a Deadly Combination

A mild to moderate infection with this bacterium affects the gut, causing watery diarrhea for two to three days and mild abdominal cramping and tenderness.[13] A severe infection can trigger diarrhea, fever, kidney failure, dehydration and weight loss.[14]

The bacteria are now able to take advantage of high sugar diets and resist disinfection commonly used in the hospital. In a recent study[15] researchers showed how C. diff can exist for long periods of time on disposable equipment and vinyl surfaces, even after having been cleaned with disinfectant.

In one study published in Nature[16] it was reported that C. diff has adapted and diverged, and is close to becoming a new bacterial species. Through a large-scale analysis of 906 cultures taken from humans, animals and the environment[17] the researchers sequenced

the bacterium's DNA and were able to demonstrate the evolving formation of a new species[18] with a change in metabolism and sporulation.[19]

The new evolution of C. diff is producing spores more resistant to hospital disinfectants that have the capacity to grow in the presence of glucose and fructose. The researchers found the new species in 70% of hospital patient samples taken for the study.

They also found this new species could colonize mice better when the animals' diet was supplemented with sugar. Analysis found this emerging species made its first appearance 76,000 years ago and has more recently begun to thrive in hospital settings. Senior author Trevor Lawley commented:[20]

> *"Our study provides genome and laboratory-based evidence that human lifestyles can drive bacteria to form new species so they can spread more effectively. We show that strains of C. difficile bacteria have continued to evolve in response to modern diets and healthcare systems and reveal that focusing on diet and looking for new disinfectants could help in the fight against this bacteria."*

C. Diff Is Commonly Found in the Environment

Another author of the paper, Nitin Kumar, Ph.D., a senior bioinformatician at the Wellcome Sanger Institute, told Popular Science:[21] "The study shows how the pathogen C. difficile is evolving in response to the Western sugary diet and common hospital disinfectants."

A New York Post journalist suggests pudding cups and instant mashed potatoes, common fare at hospitals, may be just the food this superbug is looking for.[22] According to Harvard Health, C. diff accounts for up to 3% of bacteria in a normal intestinal flora. Although present, it is usually harmless as good bacteria keep it under control.

It turns out that antibiotics have turned this minor player into a major problem.[23] Once antibiotics have disrupted the normal flora in your gut, this allows harmful bacteria to thrive, including C. diff. This in turn triggers diarrhea.[24]

C. diff forms spores that may get into the environment through those who are infected, when they touch surfaces. When others touch the newly-contaminated surfaces and then touch their mouths, the infection spreads.[25]

Health care workers may also spread the bacteria when their hands are contaminated. Since antibiotics alter the normal flora found in the intestinal tract, and a large number of patients receive antibiotics in health care settings, this can lead to C. diff outbreaks.

Poop Pills May Help Combat an Outbreak

C. diff can trigger a life-threatening condition in those who have been on antibiotics or have a compromised immune system. According to the CDC, there are 500,000 C. diff infections each year resulting in 15,000 deaths.[26] One treatment methodology is a stool transplant, which has been used throughout history.

Although new to Western medicine, fecal transplants were described as far back as 1,700 years ago by a Chinese researcher who first used what he called “yellow soup” to treat patients with severe diarrhea.[27] In World War II, the stools of camels was used to treat bacterial dysentery in German soldiers.

In 1958, the treatment was described in a report for a patient with antibiotic-associated diarrhea. But it was not until 1978 that the value was recognized in the treatment of C. diff.[28] The treatment goes under several different names including fecal biotherapy and fecal floral reconstitution.

In the past, colonoscopies have been the most successful way of introducing fecal matter into patients, but a new poop pill-popping protocol may be less invasive while still offering a life-saving option. In a trial at the University of Alberta,[29] researchers compared the administration of fecal matter using a capsule or colonoscopy.

All participants in the study had suffered a minimum of three bouts of C. diff. Both groups showed prevention of recurrent infection in 96.2% of the participants.[30] While the colonoscopy was invasive, the patient chosen to swallow pills had to down 40 capsules in one sitting.[31]

Using poop pills is noninvasive, less expensive, free of risks associated with sedation and may be done in the doctor's office. It is not, however, a treatment method you should experiment with at home. Even under investigational conditions, mistakes can be made.

In June 2019, the FDA released a statement that two immunocompromised adults had received a transplant that unwittingly transmitted a multidrug-resistant organism. At least one of those patients has died.[32]

Prevention Is Still the Best Medicine

To date, the FDA has not approved fecal transplants and continues to monitor the development as it is essential for a healthy donor to be used.[33] Open Biome maintains a list of current studies being done on fecal transplants including those to treat C. diff, inflammatory bowel disease, liver disease, obesity and depression.[34]

The single most effective means to prevent the spread of infection is through hand washing. The CDC[35] recommends cleaning your hands to prevent the spread of germs. However, they find on average health care workers do this less than half the time they should.

In one cross-sectional study[36] conducted in Nepal to assess the habits of nurses, nursing students, doctors and medical students, the researchers found a significant difference in hand washing both before and after patient care.

After exposure to instruments, blood or bodily fluid, more than 90% washed their hands. However, on average the participants tended to wash their hands selectively.

A second study of hand washing in six intensive care units revealed a high level of variability in adherence to best practices with a compliance rate ranging from 3% to 100%.[37] Take care to use proper handwashing techniques to thoroughly clean your hands and reduce the risk of transmitting disease.

A second preventive strategy includes protecting your gut microbiome from the effects of antibiotics. It is important to take antibiotics only when they're necessary. You should

not use them for viral infections, which may contribute to the development of antibiotic resistance.[38]

Support Strong Gut Bacteria for Good Health

Supporting the growth of beneficial bacteria in your gut microbiome may affect your mental and physical health. Sugar is one of the most negative culprits because it contributes to a dysfunctional gut microbiome. A study[39] published in January 2019, found that sugars affect a regulator of gut colonization for beneficial bacteria.

In essence, glucose and fructose turn off the expression of a protein regulating gut colonization by beneficial microbes. Sugar disrupts the generation of proteins that foster the growth of beneficial bacteria found in lean, healthy individuals.[40]

Since gut dysfunction may lead to a system-wide inflammatory response, it is important to address the needs of your gut bacteria consistently. As a general rule, once you start healing your gut, you should start feeling better in a couple of weeks to a few months.

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