

Probiotics Offer Powerful Protection Against Sepsis in Infants

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STORY AT-A-GLANCE

- › Each year, an estimated 1 million Americans get sepsis and up to half die. Worldwide, an estimated 600,000 infants die from sepsis, primarily in developing countries
- › Feeding newborns probiotics (healthy bacteria) for one week lowered the risk of sepsis and death by 40%, from 9% to 5.4%. Other common infections were also reduced between 34% and 82%
- › Giving septic patients intravenous vitamin C with hydrocortisone and thiamine reduced mortality nearly fivefold, from 40% to 8.5%

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As drug-resistant infections become more prevalent, so are cases of sepsis – a progressive disease process initiated by an aggressive, dysfunctional immune response to an infection in the bloodstream, which is why it's sometimes referred to as blood poisoning. Unless caught and treated early, the condition can progress to septic shock, resulting in extremely low blood pressure, weakening of the heart, multiple organ failure and death.

An estimated 1 million Americans develop sepsis each year^{1,2} and up to 50% die from the systemic infection.^{3,4,5} While illnesses such as bronchitis, pneumonia, strep throat, kidney infection or even localized infections can turn septic, **sepsis** is most commonly

acquired in hospital settings.^{6,7} Unfortunately, conventional treatment often fails, as evidenced by the 50% mortality rate.

It's also costly. According to the Agency for Healthcare Research and Quality, sepsis is the most expensive condition being treated in U.S. hospitals, racking up expenses in excess of \$24 billion in 2014.⁸ There's good news though. Evidence for not just one, but two different nondrug treatments have emerged, both of which show remarkable promise.

Infants Saved by Probiotics

Sepsis can occur in just about anyone, including infants. Research^{9,10} shows feeding newborns probiotics (healthy bacteria) significantly lowers the child's risk of developing sepsis. The study involved infants in rural India, where sepsis is common. Worldwide, an estimated 600,000 infants die from sepsis, primarily in developing countries.

The bacterial strain selected was *Lactobacillus plantarum* ATCC-202195 – a kind of lactic acid bacteria found in fermented vegetables such as sauerkraut and kimchi.¹¹ To that, they added the prebiotic fructooligosaccharide "to promote growth and sustain colonization of the probiotic strain."

The bacterial strain was chosen by methodically prescreening more than 280 strains in preliminary studies. *Lactobacillus plantarum* was in part chosen for its ability to attach to cells in the gut. According to NPR,¹² the team was "shocked by how well the bacteria worked." In infants given the synbiotic mix (probiotic plus prebiotic) for one week, the risk of sepsis and death dropped by 40%, from 9% to 5.4%.

A total of 149 villages in Odisha state, India – where infant mortality is the highest in the nation – were included in the study. While the team was initially planning to enroll 8,000 infants, the study was halted after the enrollment of 4,557 babies. Due to the clear evidence of significant benefit, it would have been unethical to continue depriving half of the newborns of the treatment.

Probiotic Also Lowered Other Infection Rates

The probiotic also reduced a number of other common infections. Respiratory infections, for example, were reduced by 34%, which was entirely unexpected. Gram-positive bacterial infections were reduced by 82% and gram-negative infections (which are more difficult to treat) dropped by 75%. Another major benefit is the price. At a cost of about \$1 per infant per weeklong course of treatment, it's incredibly affordable.

The researchers note that probiotics may be more powerful than drugs for a number of reasons. For starters, the beneficial bacteria help control harmful bacteria that may otherwise overtake the baby's gut. The probiotic also generates compounds that strengthen the intestinal wall, thereby preventing harmful bacteria from entering the bloodstream. It also helps bolster and promote healthier maturation of the baby's immune system.

Decline in Healthy Gut Bacteria Drives Up Disease Rates

Decades of overprescribing and misuse have made antibiotics a serious threat to human health by reducing healthy bacteria in the human microbiome and producing drug-resistant bacteria. As noted by Dr. Martin Blaser, director of the Human Microbiome Program at the NYU School of Medicine,^{13,14} "loss of microbes that have long accompanied humans is causing an overall rise in conditions against which our bodies can no longer defend."

Blaser links declining gut microbes to diseases such as Type 1 diabetes, autism, inflammatory bowel diseases, food allergies and much more, noting that infancy is a critical time in which your gut microbiome is developed. The increasing use of C-sections play a role here, since this deprives the baby of exposure to the mother's microbiome, which is picked up as the baby pushes through the birth canal.

Lack of breastfeeding adds to the problem, as breastmilk helps seed the baby's gut microbiome with healthy bacteria and indigestible sugars that feed the bacteria. Use of antibiotics during pregnancy and/or shortly after birth also disrupts the balance of

bacterial communities, and studies suggest taking antibiotics during pregnancy increases the risk of birth defects.¹⁵

Antibiotics may also result in permanent alterations in metabolism, increasing the child's risk of obesity later in life. Many parents are also overzealous in their use of antibacterial products, believing children must be protected against dirt and germs at all costs. This has the unfortunate side effect of weakening rather than strengthening the child's immune system.¹⁶

Getting dirty outside is actually an important part of childhood, from a health perspective, as soil-based organisms help stimulate your immune system, reduce inflammation and even aid in detoxification.

Probiotics in Wound-Healing

In related news, probiotics may also lower the risk of infections during wound-healing — including sepsis.¹⁷ As reported by Medical News Today:¹⁸

"Staphylococcus aureus is naturally present in the noses of around 30 percent of the population and mostly does not cause harm. However, when the skin barrier is broken, S. aureus can cause severe infection. S. aureus is notorious for forming biofilms. When this happens, the bacteria attach to a surface — such as the skin ...

Biofilms are mostly resistant to antibiotics and are therefore a considerable health risk. If S. aureus spreads to the blood it can cause sepsis, which is a major cause of death in children who have experienced severe burn injuries. Pseudomonas aeruginosa, which is another pathogen known to form biofilms, is often found in infected burn wounds ...

[B]oth L. rhamnosus GG and L. reuteri could protect skin cells in the laboratory from infection by S. aureus. This was true when live bacteria were added to the skin cells and when the bacteria were killed and their extracts added instead."

L. rhamnosus GG was found to promote cell migration, resulting in more rapid wound closure, while *L. reuteri* increased cell division rates, thereby aiding in the wound-healing. The idea of placing live bacteria on an open wound is questionable, but since the extract of killed bacteria proved to have a similar effect, the researchers suggest bacterial extracts may eventually be used in wound care.

Vitamin C, Another Game Changer in Treatment of Sepsis

Another important medical discovery is the use of vitamin C for the treatment of sepsis. Dr. Paul Marik, chief of pulmonary and critical care medicine at Sentara Norfolk General Hospital in East Virginia, found the deadly infection could be effectively and inexpensively treated with a combination of intravenous (IV) vitamin C, thiamine (vitamin B1) and hydrocortisone (a steroid).^{19,20}

Marik previously published a small retrospective before-after clinical study^{21,22,23} showing that giving septic patients this simple IV cocktail for two days reduced mortality nearly fivefold, from 40% to 8.5%. Of the 50 patients treated, only four died, but none of them actually died from sepsis; they died from their underlying disease.

Vitamin C is well-known for its ability to prevent and treat infectious disease. Previous research has shown it effectively lowers proinflammatory cytokines and C-reactive protein.^{24,25,26} Influenza,²⁷ encephalitis and measles²⁸ have all been successfully treated with high-dose vitamin C. To investigate the mechanism of action for sepsis, Marik reached out to John Catravas, Ph.D., a pharmacology researcher at Old Dominion University.

At Marik's request, Catravas performed an independent lab study, which confirmed the effectiveness of the treatment. Interestingly, vitamin C acts like hydrocortisone, yet when either vitamin C or the steroid was administered in isolation, nothing happened. When administered together, however, the infection was successfully eradicated.

The addition of thiamine is also important. Not only is thiamine required for metabolism of some of the metabolites of vitamin C, research has shown many patients with sepsis

are vitamin deficient, and when thiamine is given, it reduces the risk of renal failure and mortality.

Nationwide Trial of Marik's Protocol Is Underway

Sepsis kills more than breast cancer, colon cancer and AIDS combined, and Marik's protocol has not only been shown to be profoundly effective, it has no side effects, is inexpensive, readily available and simple to administer as well. Patients and doctors really have nothing to lose by trying it, but to make it standard of care across the U.S., more evidence is needed.

Sentara Norfolk General Hospital, where Marik works, has already made the protocol its standard of care for sepsis, and more than 50 medical centers around the U.S. are following suit. Still, despite the successes seen in clinical practice, many doctors are wary of implementing the protocol without further studies to support it.

To test the theory on a grander scale, Dr. Craig Coopersmith, a leading sepsis researcher at Emory University School of Medicine, is now planning a multicenter trial to put Marik's vitamin C protocol to the test across the nation. "If this is validated, this would be the single biggest breakthrough in sepsis care in my lifetime," he told Smithsonian.²⁹

Results from his field trial cannot come soon enough, as current best practices are ineffective at best. For example, research shows the standard calling for rapid and substantial infusion of IV fluids have no effect on survival rates,³⁰ and previous guidelines calling for the use of a specific drug turned out to do more harm than good.³¹ In short, there are few good alternatives available, making Marik's treatment protocol all the more crucial.

Are You at High Risk for Sepsis?

With sepsis affecting more than a million Americans each year, it's important to be aware of its signs, symptoms and risks.³² Even health care workers can miss the signs

and delay treatment. According to the Centers for Disease Control and Prevention (CDC), you're at higher risk for sepsis if you have:

- **Chronic disease** — A vast majority — 7 out of 10 — of people who develop sepsis have some kind of chronic health condition. Those with diabetes, lung, kidney or liver disease tend to be particularly susceptible to infection, which raises the risk.
- **Weakened immune system** due to AIDS or cancer.
- **Recently spent time in a hospital, nursing home or other health care facility**, as exposure to infection-causing bacteria is common in these places.

Common Sense Strategies to Reduce Your Risk of Sepsis

While health care workers have a responsibility to prevent infections that could potentially turn septic and to educate patients about warning signs of sepsis, you can lower your own risk by:

- **Promptly treating urinary tract infections (UTIs)** — UTIs are the second most common type of infection in the body, sending more than 8 million people to their health care providers every year in the U.S. alone,³³ and one-quarter of sepsis cases are related to urinary tract infections.

Conventional treatment typically involves antibiotics, but research shows 90% of UTIs can be successfully treated with D-Mannose, a naturally occurring sugar that's closely related to glucose.

- **Properly clean skin wounds** — About 1 in 10 sepsis cases are due to skin infections, so always take the time to properly clean and care for wounds and scrapes. Wash the wound with mild soap and water to clean out dirt and debris, then cover with a sterile bandage. Diabetics should follow good foot care to avoid dangerous foot infections.
- **Avoid infections in hospitals** — When visiting a health care facility, be sure to wash your own hands, and remind doctors and nurses to wash theirs (and/or change

gloves) before touching you or any equipment being used on you.

If you have to undergo a colonoscopy or other testing using a flexible medical scope, remember to call and ask how they clean their scopes and what kind of cleaning solution they use. If the answer is glutaraldehyde (brand name Cidex), find another hospital or clinic – one that uses peracetic acid. This preliminary legwork will significantly decrease your risk of contracting an infection from a contaminated scope.

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