

Fecal transplants could be used to treat intestinal disorders like inflammatory bowel disease

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Poop transplants have become routine treatment for nasty recurrent diarrheal infections, but trials for other conditions have hit a bum note. Now, the fecal faithful have re-examined the evidence.

Time and again, they found one donor whose stool was substantially more likely to lead to clinical improvement than others in the same trial. These 'super-donors' can provide the necessary bacteria to restore gut chemicals that are lacking in illnesses like IBD and diabetes, according to a new review published in *Frontiers in Cellular and Infection Microbiology*. With Alzheimer's, multiple sclerosis, cancers, asthma, allergies and [heart disease](#) all associated with changes to gut bacteria as well, understanding what makes a fecal super donor could make poop the new panacea.

Fecal transplants from super donors have high success rates

"The last two decades have seen a growing list of medical conditions associated with changes in the microbiome—bacteria, viruses and fungi, especially in the gut," says senior author Dr. Justin O'Sullivan of the University of Auckland.

"In fact, we know already that changes to the gut microbiome can contribute to disease, based on studies in germ-free mice as well as

clinical improvement in human patients following restoration of the [gut microbiome](#) by transplanting stool from a healthy donor."

While the overall cure rate for recurrent diarrheal infection exceeds 90%, trials of fecal transplantation for other conditions like inflammatory bowel disease exacerbations and type 2 diabetes have had much more mixed results, averaging nearer 20%.

"The pattern of success in these trials demonstrates the existence of 'super-donors', whose stool is particularly likely to influence the host gut and to lead to clinical improvement," explains O'Sullivan.

"We see transplants from super-donors achieve clinical remission rates of perhaps double the remaining average. Our hope is that if we can discover how this happens, then we can improve the success of fecal transplantation and even trial it for new microbiome-associated conditions like Alzheimer's, multiple sclerosis and asthma."

Super stool is rich in bacteria that enhance our metabolism

O'Sullivan and colleagues reviewed fecal transplantation trials for clues to the origin of the super-donor phenomenon.

"It is well-known that responders typically exhibit a higher microbial diversity than non-responders. In line with these observations, a larger number of species in the donor stool has been shown to be one of the most significant factors influencing fecal transplantation outcome," O'Sullivan explains.

In particular, super donor stool tends to have high levels of specific 'keystone species'. These are bacteria which produce chemicals whose lack in the host gut contributes to disease.

"In inflammatory bowel disease and diabetes for example, keystone species that are associated with prolonged clinical remission produce butyrate—a chemical with specialized functions in regulating the immune system and energy metabolism."

The keystone species theory can be tested, of course, by selecting donor stool rich in particular strains—or by designing 'precision' transplants with a defined mixture of beneficial bacteria, like a probiotic.

"This approach has been applied successfully to prevent complications in a small sample of patients with liver disease. However, this study showed that microbial enrichment in the donor does not completely guarantee enrichment in the recipient."

Viruses, immunity and diet also influence fecal transplant success

Clearly, there is more to super-donors than keystone species.

The balance of other bacteria present, and the interactions between them, seems to influence the retention of keystone species.

But digging deeper into stool samples, the researchers have discovered that it matters not only which bacteria are present, but what's present in and around the bacteria.

"For example, the success of [fecal transplants](#) has been associated in some studies with the transfer of viruses which infect other gut microbes. Some cases of recurrent diarrheal infection have even been cured with transplants of filtered stool, that has had all the live bacteria filtered out but still contains DNA, viruses and other debris.

"These viruses could affect the survival and metabolic function of

transplanted [bacteria](#) and other microbes."

Abandoning the "one stool fits all" approach

Ultimately, O'Sullivan and colleagues acknowledge that super-donors may not fully account for successful fecal transplantation.

"Some fecal [transplant](#) failures may be attributable to the gut's immune response to transplanted microbes, possibly stemming from an underlying genetic difference between the [donor](#) and the recipient."

"Supporting the transplanted microbiome through diet could also improve success. It has been shown that a rapid change in diet, such as a switch from an animal-based to an exclusively plant-based diet, can alter the composition of the gut microbiota within 24 hours."

They recommend that future fecal transplant trials routinely record information on the genetic background and dietary intake of recipients, so that we can better understand their impact on transplant engraftment and clinical remission.

More information: Brooke C. Wilson et al, The Super-Donor Phenomenon in Fecal Microbiota Transplantation, *Frontiers in Cellular and Infection Microbiology* (2019). [DOI: 10.3389/fcimb.2019.00002](https://doi.org/10.3389/fcimb.2019.00002)

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