

Can Probiotics Reduce *Candida* Infections?

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Candida in the Microflora

At least one-third of healthy individuals carry the *Candida* fungus; in the mouth, the intestine or the vagina^{1,2,3,4}. This prevalence, without symptoms, means that *Candida* can be considered a member of the normal microflora of human beings⁵. The microflora are communities of microscopic organisms that live with us for the whole of our lives, and are beneficial to our health.

Under certain circumstances, however, *Candida* fungus can cause infectious disease, which occasionally can take a very serious form. How can a microorganism be a member of our microflora and also cause disease?

The answer to this question is not yet known for certain, but it could be that *Candida* provides benefits to the host and is therefore accepted. Alternatively, *Candida* could be a pathogen that is very tricky to eradicate, but is controlled by the normal microflora. As no benefits from *Candida* have yet been identified, the second explanation seems more likely.

In most people, the risk from *Candida* is low, because the fungus constitutes a very small proportion of the overall microfloral population. Several studies have found that only about 3-4,000 *Candida* cells are present in 1 gram of content of the large intestine. This is a tiny number compared with the billions of bacteria found in the same amount of colonic content^{2,3,4,6}.

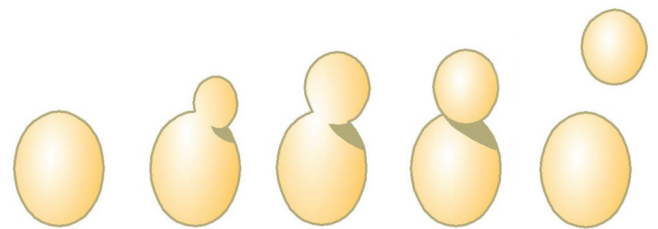
Despite the relatively low risk from *Candida* in the microflora, and the development of new anti-fungal drugs, the incidence of *Candida* infections continues to rise, especially among hospital patients⁷. For example, over a 13-year period (1980-1992) there was a 5-fold increase in bloodstream infections caused by *Candida* in US hospitals.

To understand why this is happening, it is necessary to look at *Candida* fungus in greater detail.

Why is *Candida* such a Troublesome Opportunistic Pathogen?

As a fungus, *Candida* is unlike the vast majority of microbes in the human flora, which are bacteria. A bacterium is a prokaryote (containing no nucleus or other organelles), while a fungus is a eukaryote, which is a more complex type of cell, closer in evolutionary terms to a human cell. Such greater complexity makes *Candida* a troublesome microbe when it switches into pathogenic mode.

Candida albicans is the species responsible for the majority of infections, but other species such as *Candida glabrata*, *Candida parapsilosis* and *Candida tropicalis* are also pathogenic in humans⁸.



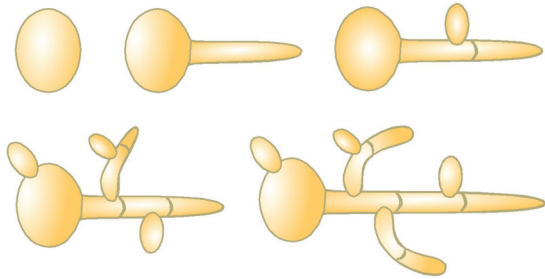
Graphics by Doig Simmonds after C.C.Odds 1988

Candida in its yeast form is considered a normal gut inhabitant when present in low numbers.

One of the reasons why *C. albicans* is such a persistent pathogen is that it can take two forms. Most of the time it exists as a single-celled yeast, but sometimes it converts to a mycelium (a network of fine filaments). The yeast-form can flow more easily in fluid and the mycelium-form can move more easily between the cells of human tissues by the insertion of growing tubes (hyphae). There is also a third and



intermediate form, known as pseudohyphae, which are strings of elongated yeast cells, and these structures also appear to have invasive ability⁹. These different forms of the fungus may all coexist together. The ability to change form, which can occur quickly¹⁰, makes it easier for *C. albicans* to resist the body's various defence mechanisms.



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The multicellular form of *Candida albicans* can make it easier to resist the body's defence mechanisms.

Candida infection (candidiasis) causes two main types of disease: superficial and systemic. Superficial infection, known as 'thrush', may occur in the mouth or vagina, with the production of a white itchy surface layer, and also discharge from the vagina⁵. Superficial candidiasis may also occur on the skin, especially at moist folds and creases.

Systemic candidiasis involves the passage of *Candida* cells into the bloodstream, where they may form colonies in almost any part of the body. Such entry through the skin or mucosal surfaces usually only occurs if there is damage to these surfaces. Systemic candidiasis can be life-threatening and is especially difficult to treat.

The increase in incidence of candidiasis infections is probably due, in part, to the greater use of broad-spectrum antibiotics that disturb the microflora. *In vitro* studies have shown that colonic microflora reduces *Candida* spp. numbers¹¹, and *in vivo* studies have shown that the use of broad-spectrum antibiotics increases the risk of candidal infection^{4,6,12}. Antibiotics kill or inhibit bacteria, but leave fungi unaffected. With the bacteria of the gut microflora disturbed, there is opportunity for *Candida* numbers to increase substantially.

Another factor in the increased incidence of *Candida* infection, is the greater use of corticosteroids and other immunosuppressive agents that alter the functioning of the immune system¹³. The relevance of a weakened immune system is reflected in the fact that leukaemia patients carry higher levels of *Candida* spp.¹⁴ and patients with HIV virus are much more likely to develop candidiasis.

The increase in *Candida* infections may also be due to the 'hygiene' effect. The hygiene hypothesis blames the increase in diseases of the malfunctioning immune system (e.g. asthma, eczema, autoimmune diseases) on the absence of

appropriate microbial stimulation at an early age. The latest version of the hygiene hypothesis proposes that the gut microflora is missing certain microbes, such as helminthic worms, that are important in an evolutionary context to the proper development of our immune systems. If infants do not have their gut lymphoid tissues suitably provoked by the gut flora, their immune system may not function efficiently in later life.

Given these potential factors behind *Candida* infection, it is no surprise that a number of experts have concluded that the most important aspect of avoiding *Candida* infection is having a balanced microbial flora and a healthy immune system^{2,13}. This has led people to consider the use of probiotics, because these beneficial microbes are good at restoring disturbed microflora and improving immune function.

Evidence of Probiotic Benefits

There have been a number of clinical studies examining the effects of probiotics on vaginal candidiasis. A group of women with recurrent vaginal candidiasis consumed yoghurt containing *Lactobacillus acidophilus* for six months, and there was a three-fold lower level of infections compared to the control group¹⁵.

In a more recent randomised controlled trial (RCT), an oral probiotic consisting of two *Lactobacillus* species (a *Lactobacillus rhamnosus* and a *Lactobacillus reuteri*) significantly improved the effectiveness of an anti-fungal drug. Vaginal discharge was reduced, as were *Candida* cell numbers¹⁶.

There have also been two studies in which the probiotics were administered vaginally. One used a *L. rhamnosus* and the other used a *L. acidophilus*. Both showed benefit, including a halving of the risk of developing candidiasis in the latter study¹⁷.

A RCT has also been undertaken with 80 premature infants, with a view to preventing candidiasis. *Candida* can be a major threat to the lives of such infants with their underdeveloped immune systems. The group of infants receiving *L. rhamnosus* for six weeks were significantly less likely to have their intestine colonised by *Candida* (23% compared with 49% in the control group)¹⁸.

Different Species

A number of different probiotic species were used in the above studies, so how important is the type of species used in a probiotic product? By definition, species of bacteria have different characteristics. In fact, even within a species, some strains behave slightly differently. Therefore it can be expected that some probiotic bacteria will be more effective against *Candida* than others.



Furthermore, the mechanisms of benefit from probiotic bacteria are wide-ranging. This should not be surprising, because we are dealing with a living organism (the bacterium) interacting with cells of another organism (human being). Their complicated metabolisms and surface structures are bound to offer a range of potential influences.

The importance of species used was demonstrated in one study of mice using four different probiotic species. Two of the species (*Bifidobacterium animalis* and *L. acidophilus*) were superior to the other two (*L. reuteri* and *Lactobacillus casei*) in controlling *Candida*¹⁹.

Conclusion

Unfortunately, good quality studies on the use of probiotics against candidiasis are still relatively uncommon, and a clear picture of the most desirable characteristics of a probiotic species has not yet been obtained. Pending more research, it may be that a good quality, multi-species probiotic is currently the best choice.



Candida infections can occur in men as well as women.

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Peter Cartwright has 17 years experience of working for patient and self-help associations, as Assistant Director of the National Association for Colitis and Crohn's Disease, Director of the British Stammering Association and National Development Officer of the Self-Help Alliance. Currently he is a Trustee of the Bladder & Bowel Foundation. Peter has an MSc in Microbiology and an MA in Sociology. He is the author of three books for the general public on intestinal health, including *Probiotics for Crohn's and Colitis* and has given over 40 lectures on probiotics to doctors in 10 countries.

Probiotics International Ltd is one of the largest manufacturers and suppliers of probiotic supplements for the healthcare, veterinary and animal health industry. Products are marketed under the brand name of Protexin.

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