

## Fungal Infections (Candida)

Fungal infections are more common today than ever before. There are a number of reasons for this. People are living longer, and older people are more likely than younger people to have compromised immune systems, a major risk factor for fungal infection. Similarly, the widespread use of antibiotics has contributed to the growing infection rate (fungal infections are known to occur after antibiotic therapy, which has the effect of killing the beneficial bacteria that normally suppress fungi). Finally, the success in treating diseases like HIV/AIDS has created a subgroup of the population susceptible to fungal infections (Nola I et al 2003).

The most common organism implicated in fungal infections is the ubiquitous *Candida*, which is found in the human digestive tract, mouth, and genital region (Eggiman P et al 2003). Under normal circumstances, levels of *Candida* are controlled by beneficial bacteria. However, if the bacteria-fungus balance is upset, by the use of antibiotics for example, or if the immune system is compromised, an overgrowth of *Candida* can occur, resulting in infection (Braunwald DE 2001).

Fungal overgrowth is encouraged by certain pH levels and the availability of sugar (glucose) (McGinnis MR et al 1996; Buddington RK et al 1996; Howard MD et al 1995). People with the right conditions for fungal infection, such as a high sugar diet, are at higher risk. Also, candida infections can be spread to vulnerable people with depressed immune systems who are in the hospital, where the fungus is commonly found on the hands of caregivers and where indwelling catheters can allow an infection to take hold.

Several areas may be affected by fungal infection:

**Genitals.** Vulvovaginal infections are among the most common infections caused by *Candida albicans*. Most women experience a vaginal candida infection at some point in their lifetimes (Edwards L 2004); about 75 percent of cases occur during the reproductive years (Mitchell H 2004).

Symptoms of a vulvovaginal infection include itchiness, occasionally accompanied by irritation or burning. While *C. albicans* is one of the most common causes of vulvovaginal infections, they can also be caused by bacteria (Edwards L 2004). Additional symptoms may include painful intercourse or urination and redness of the vulva and inner thighs. Yeast infections, caused by *C. albicans*, occur most often when pH changes occur as a result of hormonal fluctuations, such as prior to and after menstruation, during perimenopause, or while taking oral contraceptives (Edwards L 2004).

**Skin.** Candida infection of the skin usually occurs between the fingers, toes, around the anus (*Candida albicans* is commonly found in feces), and on the penis. A rash on the inner thighs can accompany infection in the rectal and genital areas. A skin fungal infection generally occurs at the site of an abrasion or where skin is continuously moist. Dishwashers, for example, often develop fungal infections around or under their fingernails (paronychia or onychomycosis, respectively), resulting in painful swelling and secretion of pus from the nail beds. Infected nails may turn white or yellow and separate from the surrounding skin. Similarly, workers whose feet are submerged in water or who wear rubber boots every day may develop fungal infections around their toenails. Cutaneous infection also occurs under skin-folds (intertrigo), such as under pendulous breasts or genital skin folds (Bennett JE 2004a,b).

**Mouth and throat.** Oral candidiasis, or thrush, occurs in the mouth. It appears as white areas or patches on the lips, tongue, inner cheeks, or roof of the mouth. These lesions are usually painless unless they occur at the corners of the mouth (perlèche). Perlèche is a candida characterized by cracks and tiny cuts at the corners of the mouth, a condition often caused by ill-fitting dentures (Braunwald DE 2001). Oral thrush occurs most commonly in neonates and immunocompromised individuals, especially people infected with HIV (Bennett JE 2004a,b).

**Systemic infection.** Under normal circumstances, trace amounts of *Candida* can be found in the gut and in various locations in the body. Among people with decreased immunity, however, occasionally candida infections can occur throughout the body. Systemic, or deep, candida infections are serious medical conditions that require immediate medical treatment. There is no such thing as a low-grade systemic candida infection with mild symptoms. Invasive candida infections are characterized by fever and shock, including low blood pressure, an elevated heart rate, respiratory distress, multiorgan distress, and sometimes a systemic rash or skin peeling. This is a dangerous, even potentially fatal, condition.

Systemic candida infection usually occurs in people with one or more of the following: skin and mucosal damage, long-term administration of corticosteroids, decreased immunity, organ or stem cell transplantation, or critical illness requiring hospitalization in intensive-care (CDC 2003).

If candidiasis is associated with diabetes or malignancy, the underlying disease must be treated in order to discourage yeast

growth. Invasive disease (deep candidiasis) may affect major organs, such as the kidneys, spleen, liver, lungs, eyes, brain, and heart. Organ involvement can lead to organ failure if infection is not treated quickly and effectively.

## DIAGNOSIS AND CONVENTIONAL TREATMENT

Diagnosis of candida infection can often be accomplished by the presence of symptoms alone. To confirm the diagnosis, however, samples of the fungus have to be identified under a microscope. During this test, scrapings or smears of the tissue are taken from skin, nails, oral mucosa, and vaginal mucosa and identified with a low-powered microscopic examination, a process that gives immediate results (Edwards L 2004). Biopsy samples may be taken from deeper lesions. Candida antibody levels in the blood can also be measured (Braunwald DE 2001).

It may also be helpful to measure the pH of the stomach and first part of the small intestine because abnormalities in the acid environment of the stomach can encourage fungal infection. This can be determined with the noninvasive Heidelberg test. The Heidelberg pH Capsule Gastric Analysis requires swallowing a small capsule that contains a sensitive pH probe and radio transmitter (Barrie SA 1992). The probe measures pH values of secretions in the stomach and small intestine and transmits the values to an external receiver. The capsule passes harmlessly through the stomach and intestines and is eventually excreted. Abnormal acid conditions may indicate elevated risk for a fungal infection.

Once a candida infection is diagnosed, its treatment depends on where it is located. In many cases, a topical antifungal medication will be prescribed. Common antifungals include butoconazole, clotrimazole and nystatin. Oral fluconazole is sometimes used to treat recalcitrant cases of vaginal yeast infection, but it can have unpleasant gastrointestinal side effects (PDR 2004).

People with cutaneous infections are usually instructed to keep the affected areas as dry as possible until the infection has cleared. Doing so may mean changing out of a wet bathing suit or out of damp workout clothes as soon as possible. Antifungal shampoos are available, as well as antifungal mouth rinses. Infection does not always respond quickly to these treatments and may recur when topical application is discontinued.

People with life-threatening systemic fungal infections are usually treated with intravenous amphotericin B for two weeks (Sheppard D et al 2004), although oral fluconazole may be effective. Intravenous amphotericin must be administered in a hospital; its side effects include blurred vision, convulsions, pain, and troubled breathing, among others.

## NUTRITIONAL APPROACHES TO HEALTHY INTESTINAL BACTERIA

Women with chronic yeast infections, or people at risk for fungal infections, may want to consider supplementing their diets with foods and nutrients that have been shown to discourage fungal infection in the first place. Probably the most effective method is to maintain a healthy population of beneficial bacteria in the gut, which can reduce the risk of vaginal infections (Elmer GW et al 1996).

**Yogurt and probiotics.** Studies have shown that daily ingestion of 150 mL of yogurt enriched with live *Lactobacillus acidophilus* can increase levels of friendly bacteria in the rectum and vagina (Shalev E et al 1996). Studies have shown that a daily cup of yogurt significantly reduces the risk of candida infection and colonization (Hilton E et al 1992). This therapy is generally well tolerated, except among people with specific milk protein allergies. Even people who are lactose intolerant oftentimes find that yogurt is tolerable.

**Fructooligosaccharides.** Fructooligosaccharides are a form of sugar that has been shown to boost beneficial bacteria levels. One teaspoon (4 g) daily of fructooligosaccharide promotes the proliferation of friendly bifido bacteria in the gut (Howard MD et al 1995; Oyarzabal OA et al 1995; Buddington RK et al 1996).

## OTHER NUTRIENTS THAT FIGHT FUNGAL INFECTION

Certain nutrients have been shown to reduce the risk of fungal infection by attacking the organisms directly or enhancing the immune response. These include the following:

**Goldenseal.** The active ingredient of the herbal root goldenseal is called berberine. One of its many pharmacologic actions is metabolic inhibition of certain organisms, including fungi. In animal studies, it has been shown to work synergistically with intravenous amphotericin B, allowing dramatic reductions in dosages (Han Y et al 2005). Berberine has also demonstrated direct antifungal activity in laboratory studies (Slobodnikova L et al 2004).

Additional antimicrobial compounds have been identified in goldenseal. Nine compounds have been isolated from a commercially available sample of goldenseal root (*Hydrastis canadensis*).

**Lactoferrin.** Several studies have found that lactoferrin, a subfraction of whey protein, inhibits a wide range of bacteria, yeasts, and

even certain intestinal parasites. Lactoferrin taken orally appears to survive absorption in the stomach and can make its way into secretory tissue such as breast and salivary glands (Percival M 1997; Lupetti A et al 2002). It has been described as an important part of the primary host immune defense against microbes including *Candida* (Orsi N 2004). *C. albicans*, in particular, has been proven to be inhibited by lactoferrin (van der Kraan MI et al 2005). In lab studies, the majority of *C. albicans* isolates succumbed to lactoferrin (Samaranayake YH et al 2001).

Lactoferrin worked well in combination with fluconazole, a prescription antifungal agent (Kuipers ME et al 1999), demonstrating that lactoferrin and antifungal medications work together to reduce oral yeast infections in HIV-infected individuals. In a different study human lactoferrin was effective against candida strains that had become resistant to fluconazole and amphotericin B, raising the possibility of a potent new therapy (Viejo-Diaz M et al 2005).

**Tea tree oil.** Studies have demonstrated the antifungal properties of the oil of the tea tree (*Melaleuca alternifolia*) against a wide range of fungal isolates, including *Candida*. Controlled doses of tea tree oil may be used as an effective topical treatment for dermatologic *Candida* infection and paronychia. The mechanism of action of tea tree oil against *C. albicans*, *C. glabrata*, and *Saccharomyces cerevisiae* was studied by treating each strain of yeast with tea tree oil for up to six hours. Colonies were labeled with methylene blue to help researchers observe alterations in membrane permeability. Membrane fluidity was determined by fluorescence. The studies found that the antifungal properties of tea tree oil lie in its ability to disrupt the yeast cell wall (Hammer KA et al 1997, 1997; Rushton RT et al 1997).

**Essential oils.** Oils from various herbs, including clove, cayenne, and especially oregano, have been tested against *Candida* organisms (Hronek M et al 2005; Tampieri MP et al 2005). In a study on immunosuppressed animals, oregano and clove oil reduced the number of colony counts in samples of oral tissue (Chami N et al 2005). Oregano oil in combination with clove oil has also been shown to reduce the fungal load, which would decrease the risk of candida infection in animal models of vaginal candida infection (Chami F et al 2004).

**Garlic.** Garlic has a number of antimicrobial properties and has been shown to inhibit the growth of candida in the laboratory (Iwalokun BA et al 2004). Lab studies have revealed that candida is especially sensitive to a purified extract of garlic known as allyl alcohol, which produced oxidative stress inside the yeast organism and inhibited its growth (Lemar KM et al 2005). Other studies have demonstrated that garlic extracts begin exerting their anticandidal effect within one hour of ingestion (Hronek M et al 2005).

## LIFE EXTENSION FOUNDATION RECOMMENDATIONS

People who suffer from a yeast infection or are at high risk for a yeast infection may want to make lifestyle changes that have been shown to reduce the risk and severity of yeast infections. The following lifestyle modifications may be effective (Hudson T 2003):

- Reducing or avoiding refined sugar
- Avoiding foods with a high yeast content
- Eating 8 oz yogurt daily to restore normal flora in the digestive tract (especially beneficial with oral or vaginal yeast infections)
- Getting ample sleep
- Losing weight if necessary
- Keeping affected areas dry
- Avoiding tight clothing and pantyhose

In addition, the following nutrients may help reduce the risk and severity of candida infections.

- **Probiotics**—up to 900 milligrams (mg) daily of beneficial bacteria, including lactobacillus and bifidobacterium strains
- **Fructooligosaccharides**—up to 4 grams (g) daily
- **Goldenseal**—250 to 750 mg daily
- **Lactoferrin**—300 mg daily
- **Topical tea tree oil**—Follow label directions
- **Oil of oregano**—460 mg daily
- **Garlic**—600 mg daily kyolic garlic
- **Boric acid** in a topical solution has been shown to help cure fungal infections (Jovanovic R et al 1991; Sobel JD et al 2003; Guaschino S et al 2001). One study found that doses of 600 mg daily for two to three weeks were effective in about 65 percent of women with vaginal candida infections (Sobel JD et al 2003).

## CANDIDA AND FUNGAL INFECTIONS SAFETY CAVEATS

An aggressive program of dietary supplementation should not be launched without the supervision of a qualified physician. Several of

the nutrients suggested in this protocol may have adverse effects. These include:

### **Goldenseal**

- When taken for an extended period of time, goldenseal may cause digestive problems, constipation, nervous excitement, hallucinations, and delirium.
- Do not take goldenseal for more than 3 weeks in a row. Wait at least 2 weeks before resuming use of goldenseal.

### **Garlic**

- Garlic has blood-thinning, anticlotting properties.
- Discontinue using garlic before any surgical procedure.
- Garlic can cause headache, muscle pain, fatigue, vertigo, watery eyes, asthma, and gastrointestinal symptoms such as nausea and diarrhea.
- Ingesting large amounts of garlic can cause bad breath and body odor.

For more information see the Safety Appendix

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