

Candida Albicans: The Invasive Friend of Internal Body World

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ABSTRACT

Candida is a friendly yeast found in the body for beneficial reasons. It can live in all parts of the digestive system, mouth and in women's vaginas. Candida albicans inhibits the growth of other pathogens through its presence in the digestive tract. When Candida albicans is present in the body at the required level, it helps the absorption of nutrients as well. The body's immune system and other harmless bacteria can usually control Candida. Due to various reasons, the balance of the intestinal flora deteriorates and the rapidly increasing number of Candida yeasts can cause pathological conditions in their hosts. If the immune system is not strong enough, it will begin to spread through the blood in the veins. At that time, it becomes an unexpected designer of the serious infections throughout the body. Therefore, early diagnosis and treatment methods of Candida are very significant as it is for other infection creators.

Keywords: candida, yeast infection, candidemia, immunosuppressed patients, pathological conditions

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INTRODUCTION

It is understood that there are about 400,000 species of mushrooms on earth. Only about 200 of them cause diseases in humans and animals. 90% of fungal infections are caused by up to 10-20 of these different species. Fungi can be seen almost everywhere in nature, and the natural flora of a healthy human body also includes various types of fungi and bacteria. Fungi usually continue to exist in the body without causing any disease. However, due to various reasons, the balance of the intestinal flora deteriorates, and the fungus multiplies rapidly, which can cause infection. The severity of infection is mainly based on the immune status of the host exposed to the infection, that is, the strength of the immune system.

Candida (Candida albicans) is a yeast that can be found not only in humans, but also in all living things [1]. It can live in all parts of the digestive system and in women's vaginas. Trillions of bacteria live in the intestines. If the intestinal balance is disturbed by various factors, Candida can

also be affected. As a result, the rapidly increasing number of Candida yeasts can cause pathological conditions in their hosts. It can be said that the most common pathogenic bacteria in humans is Candida. Candida albicans is part of the microorganisms that live in our bodies. It is a sexually reproduced diploid yeast that can survive in the gastrointestinal tract, oral cavity and vagina. Candida albicans is one of many organisms living in the human mouth [2] and digestive tract [3]. It can be found in the mouth of 40% of healthy adults and the vagina of 20-25% of healthy women [4]. Candida albicans inhibits the growth of other pathogens through its presence in the digestive tract. The body's immune system and other harmless bacteria can usually control Candida. When Candida albicans is present in the body at the required level, it helps the absorption of nutrients. It is sometimes called yeast. But when it multiplies too much, it becomes a pathogenic fungus. When overbreeding, humans are more likely to encounter negative health problems. Although there are 200 species belonging to the genus.

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Candida, *Candida albicans* accounts for 75% of Candida infections. The species name *albicans* comes from the Latin word, meaning “white”. Yeast appears white when grown in a petri dish. Some infections, such as thrush, can cause leukoplakia. Systemic fungal infection (fungemia) is one of the main causes of morbidity and death in immune compromised patients (cases of AIDS, cancer chemotherapy, organ, or bone marrow transplantation [5]. In addition, the hospital infection of patients who are not at risk in this direction has become a serious health problem. Removing yeast-containing products from your diet is the most important thing to eliminate the symptoms caused by Candida.

Antibiotics, antacids, gastric ulcer and reflux drugs, birth control pills, sugary and white flour foods, hormonal foods, cortisone used in treatment, drinking chlorinated water, intestinal parasite infections, drinking alcohol, fat-free diet, ingestion of heavy metals, and heavy metals-containing dental treatments lead to a decrease in beneficial bacteria and an explosion of Candida populations in the intestines. The symptoms of Candida are as follows:

- a. Cold hands and feet and lower body temperature;
- b. Excessive consumption of sugar, bread, pasta, and other high-carbohydrate foods has reached the level of addiction;
- c. Digestive problems, diarrhea, constipation, bloating and abdominal pain, gas, fecal mucus, and ulcers;
- d. Tinnitus, hearing sound, inflammation, pain, ear secretions, effusion, and hearing impairment;
- e. Visual disturbance, floating point, flashing light, redness, dryness, itching, and excessive tearing of eyes;
- f. Chronic fatigue, feeling exhausted, and drowsy;
- g. Hair loss, dandruff, scalp itching, pain, and dryness;
- h. Headache, migraine, and dizziness;
- i. Low sugar (hypoglycemia) and diabetes;
- j. Hashimoto’s disease, hyperthyroidism, and irregular thyroid movement;
- k. Irritability and panic attacks;
- l. In men: genital itching, decreased libido, and erection problems;
- m. In women: infertility, unpleasant smell, irregular menstruation and pain, itching, discharge, pain or pain during intercourse, and decreased libido;
- n. Joint pain, stiffness, or swelling (arthritis);
- o. Mental health, anxiety, depression, loss of memory, and emptiness; and
- p. In mouth: ulcers and pain, mouth ulcers, bad breath, and leukoplakia in mouth (thrush).

It is recommended that the Candida diet can have a positive effect on the infected person. Generally speaking, the Candida diet is composed of:

- a. Vegetables with low starch content, foods rich in probiotics, low-sugar foods, gluten-free grains, and protein foods;
- b. Vegetables with low starch content like artichokes, asparagus, broccoli, Brussels sprouts, broccoli, spinach, tomatoes, cucumbers, eggplants, zucchini, celery, cabbage, onions, and garlic;
- c. Fruits with low sugar content like avocados and lemons;
- d. Cereal group like gluten-free cereals such as buckwheat, oats, quinoa, thrush, and amaranth;
- e. Protein sources like eggs, chicken, turkey, anchovies, herring, salmon, sardines, dairy products, yogurt, and kefir;
- f. Healthy fats such as olive oil, coconut oil, linseed oil, almond oil, walnut oil, and hazelnut oil;
- g. Oilseeds like walnuts, almonds, hazelnuts, linseeds, and sunflower seeds;
- h. Spices and condiments such as basil, black pepper, cinnamon, cloves, dill, garlic, ginger, thyme, paprika, rosemary, salt, and apple cider vinegar; and
- i. Source of sugar like herbal sweeteners such as stevia instead of sugar.

Top ten foods that are accepted as Candida killers are as cinnamon, avocado oil, coconut oil, garlic, lemon, turnip, onion, pumpkin seeds, ginger, and olive oil.

It is important to avoid the foods listed in the Candida diet:

- a. Fruits high in sugar: all fruits except avocados and lemons;
- b. Cereal group: all gluten-containing cereals such as rye, barley, rice, white flour, and wheat;
- c. Dairy products: milk, cream, cheese, and whey;
- d. Meat group: processed meat and products, shellfish, swordfish, and tuna;
- e. Oil group: rapeseed oil, sunflower oil, margarine, soybean oil, peanuts, cashews, and pistachios;
- f. Sugary foods and sweeteners: honey, molasses, sugar, aspartame, corn syrup, and maple syrup;
- g. Sauces: ketchup, mayonnaise, barbecue sauce, and soy sauce; and
- h. Beverages: black tea, coffee, carbonated drinks, energy drinks, fruit juices, and all alcoholic beverages.

It is also important to understand the causes and methods of *Candida albicans* reproduction. It is a harmless fungus under normal conditions (symbiosis), but can cause disease when the body’s balance is disturbed. When an

individual's immune system, normal flora or normal physiology changes, the infectious overgrowth of *Candida* usually occurs. If the immune system is not strong enough, it will begin to spread through the blood in the veins. Long-term antibiotic or steroid treatment can disrupt the normal balance of the intestinal flora and cause *Candida* to cause disease. Surgical applications such as heart surgery can cause changes in the patient's physiology. The use of contraceptives or hormone therapy can increase estrogen levels, stress and fatigue, which may lead to *Candida* infection in some patients. Hormonal imbalance can also cause an excessive increase in *Candida* and cause infection. *Candida* mostly infects the skin and mucous membranes in humans. However, it can cause vital symptoms such as pneumonia, septicemia or endocardium in people who are immune compromised for various reasons.

INFECTIONS CAUSED BY CANDIDA

Genital or Vulvovaginal Candidiasis (Yeast Infection)

It causes vaginal discharge with itching and burning sensation in the genital area of the patient [6]. In men, the penis may be itchy. It is a more common infection in women.

In addition, women may also be at increased risk of infection in certain situations such as pregnancy, diabetes, antibiotic use, and corticosteroid use.

Oral Candidiasis (Oropharyngeal Candidiasis)

Candida infection in the mouth is also called thrush among the people. White rashes on the tongue and mouth, inflammation, and infected cracks around the mouth can be seen [7]. It is also called oral chills. In advanced cases, it can spread to the esophagus (esophagitis). Oral candidiasis is especially common in people who are critically immune compromised such as HIV-infected persons, AIDS patients, cancer patients undergoing chemotherapy treatment, and people who have to take immunosuppressive drugs for therapeutic purposes. It is also more likely to be seen in people with diabetes, people who receive denture treatment, and people who use corticosteroids.

If *Candida* enters your bloodstream, it can cause serious infections not only in your blood but in other organs as explained in the following subsections.

Invasive Candidiasis (Candidemia)

This is a serious disease that occurs when *Candida* enters the bloodstream and spreads to other organs. Symptoms may be chills, fever, kidney failure, or shock. It is usually diagnosed in patients with vascular catheters, immunosuppressed patients, long-term antibiotics, neutropenia, patients undergoing hemodialysis, and diabetic patients [8].

Neutropenia

An important risk factor for the development of more aggressive candidiasis is neutropenia. This is when the level of cells called neutrophils in the blood is abnormally low. It

will make humans more susceptible to infection [9]. People who are usually affected by neutropenia include people having received chemotherapy or radiation therapy for cancer, as well as people having leukemia or other bone marrow diseases.

Intra-Abdominal Candidiasis

Intra-abdominal candidiasis can also be called candidal peritonitis. This is inflammation of the inner abdomen wall caused by yeast infection [10]. This condition is most commonly caused by *Candida albicans*, although other *Candida* can also cause it. Some of the risk factors for intra-abdominal candidiasis include recent abdominal surgery or surgery, peritoneal dialysis, antibiotic therapy, and diabetes. Symptoms of intra-abdominal candidiasis may include abdominal pain or bloating, fever, nausea and vomiting, feeling tired or tired, diarrhea, and loss of appetite.

Endocarditis

Endocarditis is an infection of the lining of the heart, including the heart cavity and valves. Fungal endocarditis is a very serious disease with a high mortality rate [11]. *Candida albicans* accounts for 24% to 46% of all fungal endocarditis cases and causes of sepsis with an average mortality rate between 20 to 25% [12]. Risk factors for this situation include a weakened immune system, heart abnormalities or defects, long-term use of antibiotics, cardiovascular surgery, and implantation of medical equipment such as feeding tubes, catheters, or artificial heart valves [13]. Symptoms of fungal endocarditis may include fever, cough, difficulty breathing, and body pain, sometimes in the lower extremities.

Osteomyelitis and Fungal Arthritis

Osteomyelitis is a bone infection, while fungal arthritis is a fungal infection of the joints. Both of these conditions can be caused by *Candida*, although this is rare [14]. Bacterial infections are more common. Risk factors could be written as weakened immune system, orthopedic surgery, and catheter disease. Symptoms of these conditions include pain or swelling in the affected area, which may be accompanied by fever or chills. It is also difficult for people with fungal arthritis to use the joint diagnosed with *Candida*.

Endophthalmitis

Endophthalmitis [15] is an inflammation of the eye caused by a fungus. It may cause loss of vision. Risk factors contain recent hospitalization and/or surgery, and weakened immune system, and intravenous injection. The main symptom is inflammation of the eyes, but in some cases, pus may appear in the eye tissues.

Meningitis

Meningitis is inflammation of the tissues surrounding the brain and spinal cord. Fungal meningitis occurs when fungus spreads through the blood to your spinal cord. Fungal meningitis caused by *Candida* is usually infected in the hospital [16]. The risk factors can be listed as antibiotics,

immunosuppression, or corticosteroids, and recent made surgery. Symptoms may be headache, stiff neck, fever, nausea and vomiting, sensitivity to light, and confusion.

CONCLUDING REMARKS

Since *Candida albicans* can cause serious infections, it is very important to understand the hazards of *Candida* in detail. It usually reproduces by depositing in the mouth and intestines. This yeast also has a very important function in the lymphatic system. Due to the influence of external factors, the reproduction speed is very fast. The toxic substances they produce can cause damage to all parts of the body. In addition to intestines, oral cavity, and genital area, it can also be encountered in the lungs and bladder. Many factors, from antibiotics used to foods eaten, can effectively provide suitable conditions for the proliferation of *Candida*. *Kandina* stabilizes and binds to the tissues and begins to produce adhesin. By destroying tissues, it gradually weakens the immune system and cannot fully perform its functions.

Early diagnosis of *Candida* is important as it is for other infection creators. *Candida* species reproduce in simple culture media under aerobic conditions, at 25-37°C and in 24-72 hours. The clinical material to be tested in the laboratory depends on the course of the disease: blood cultures, vaginal discharge, pee, feces, nail sample or includes material from cutaneous or mucocutaneous lesions. *Candida* species form creamy-white yeast colonies on blood culture bottles and agar media. *Candida albicans* and non-*albicans* *Candida* species can also be easily distinguished in selective culture medium (CHROM agar *Candida*) [17]. Tests that look for *Candida Albicans* IgE antibody in the serum can also be used for diagnosis. For the cure, it is important to initiate the treatment with the right leader of the medication because *candida* is very successful of adopting itself to the environment and also to the newly developed one.

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REFERENCES

- Gow NAR, Yadav B. Microbe profile: *Candida albicans*: A shape-changing, opportunistic pathogenic fungus of humans. *Microbiology (Reading)*. 2017;163(8):1145-7. doi: 10.1099/mic.0.000499.
- Ghannoum MA, Jurevic RJ, Mukherjee PK, et al. Characterization of the oral fungal microbiome (mycobiome) in healthy individuals. *PLoS Pathog*. 2010;6(1):e1000713. doi: 10.1371/journal.ppat.1000713.
- Hoffmann C, Dollive S, Grunberg S, et al. Archaea and fungi of the human gut microbiome: Correlations with diet and bacterial residents. *PLoS One*. 2013;8(6):e66019. doi: 10.1371/journal.pone.0066019.
- Arce K, Schliephake H, eds. Oral and maxillofacial surgery. Oxford: Oxford University Press, 2010:446-7.
- Calderone RA, Clancy CJ, eds. *Candida and candidiasis* (2nd ed.). ASM Press, 2012:544. doi: 10.1128/9781555817176.
- Pereira LC, Correia AF, da Silva ZDL, et al. Vulvovaginal candidiasis and current perspectives: New risk factors and laboratory diagnosis by using MALDI TOF for identifying species in primary infection and recurrence. *Eur J Clin Microbiol Infect Dis*. 2021;40(8):1681-93. doi: 10.1007/s10096-021-04199-1.
- Lu S-Y. Oral candidosis: Pathophysiology and best practice for diagnosis, classification, and successful management. *J Fungi (Basel)*. 2021;7(7):555. doi: 10.3390/jof7070555.
- Pfaller MA, Diekema DJ. Epidemiology of invasive candidiasis: A persistent public health problem. *Clin Microbiol Rev*. 2007;20(1):133-63. doi: 10.1128/CMR.00029-06.
- Frater JL. How I investigate neutropenia. *Int J Lab Hematol*. 2020;42(Suppl1):121-32. doi: 10.1111/ijlh.13210.
- Bassetti M, Righi E., Ansaldi F, et al. A multicenter multinational study of abdominal candidiasis: Epidemiology, outcomes and predictors of mortality. *Intensive Care Med*. 2015;41(9):1601-10. doi: 10.1007/s00134-015-3866-2.
- Habib G. Management of infective endocarditis. *Heart*. 2006;92(1):124-30. doi: 10.1136/hrt.2005.063719.
- Cuervo G, Escriva-Vidal F, Gudiol C, Carratalà J. Current challenges in the management of infective endocarditis. *Front Med (Lausanne)*. 2021;8:641243. doi: 10.3389/fmed.2021.641243.
- Rajani R, Klein JL. Infective endocarditis: A contemporary update. *Clin Med (Lond)*. 2020;20(1):31-5. doi: 10.7861/clinmed.cme.20.1.1.
- Kohli R, Hadley S. Fungal arthritis and osteomyelitis. *Infect Dis Clin North Am*. 2005;19(4):831-51. doi: 10.1016/j.idc.2005.08.004.
- Pandya HK. Postoperative endophthalmitis treatment & management. 2019. Available at: <https://emedicine.medscape.com/article/1201260-treatment>
- Lass-Flörl C, Samardzic E, Knoll M. Serology anno 2021-fungal infections: From invasive to chronic. *Clin Microbiol Infect*. 2021;27(9):1230-41. doi: 10.1016/j.cmi.2021.02.005.
- Ozcan K, Ilkit M, Ates A, Turac-Bicer A, Demirhindi H. Performance of chromogenic *Candida* agar and CHROMagar *Candida* in recovery and presumptive identification of monofungal and polyfungal vaginal isolates. *Med Mycol*. 2010;48(1):29-34. doi: 10.3109/13693780802713224.