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Immunological Study About *Blastomyces dermatitidis*

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ABSTRACT

Blastomycosis is a disease caused by a type of dimorphic fungus called *Blastomyces dermatitidis*, which is the fungus in which the Central United States is an endemic area.

These fungi multiply in nature in the form of filaments, or what is known as the filamentous form (Mold) and transform in the body from filamentous form to the yeasty form (yeast). The infection is transmitted by inhalation of conidia, or what is known as the external spores that the fungus produces, through the respiratory tract.

Healthy people who develop spondylosis recover automatically, and the spermatozoa breakfast has symptoms that include fever, in particular, feeling weak and losing weight. Sometimes, especially in people with impaired functioning of the immune system, systemic disease can develop - affecting many body systems and organs.

The most common symptom in these patients is pneumonia, followed by skin lesions (cauliflower or ulcerative lesions), osteomyelitis, prostatitis, or an infection of the central nervous system, some of those who breathe may have flu-like symptoms. in people with weakened immune systems, the infection can become severe, especially if it spreads from the lungs to other organs.

INTRODUCTION

Blastomyces Dermatitidis is a biphasic fungus that causes what is known as Blastomycosis. The infection appears as a primary or acute respiratory infection. but this fungus can affect any organ, as Figure (1) *Blastomyces dermatitidis* shown in and then the infection can appear as skin lesions (Ibrahim *et al.*,2017). Patients experience fever, chills, heavy sweating, sometimes chest pain, difficulty breathing, and coughing (Hussain *et al.*, 2018).

The infection may spread to the skin, bones, genital tract, urinary system and tissues that cover the brain, causing swelling, pain and other symptoms. doctors remove a sample from the infected sputum or tissue and send it to the laboratory for culture (Ibrahim *et al.*,2017).

Patients should take antifungal medications for months. most cases of blastomycosis occur in areas of North America where fungi live in the soil near the river course (Bander *et al.*, 2015); (Hussain *et al.*, 2018); (Dahham *et al.*, 2019). Ohio

Valleys and the Mississippi River (extending to the states of the Middle Atlantic Region and southeastern states), Northwestern North New York State Southern infection occurs on rare occasions in the Middle East and Africa (Kaufman *et al.*, 2001); (Green *et al.*, 2002).

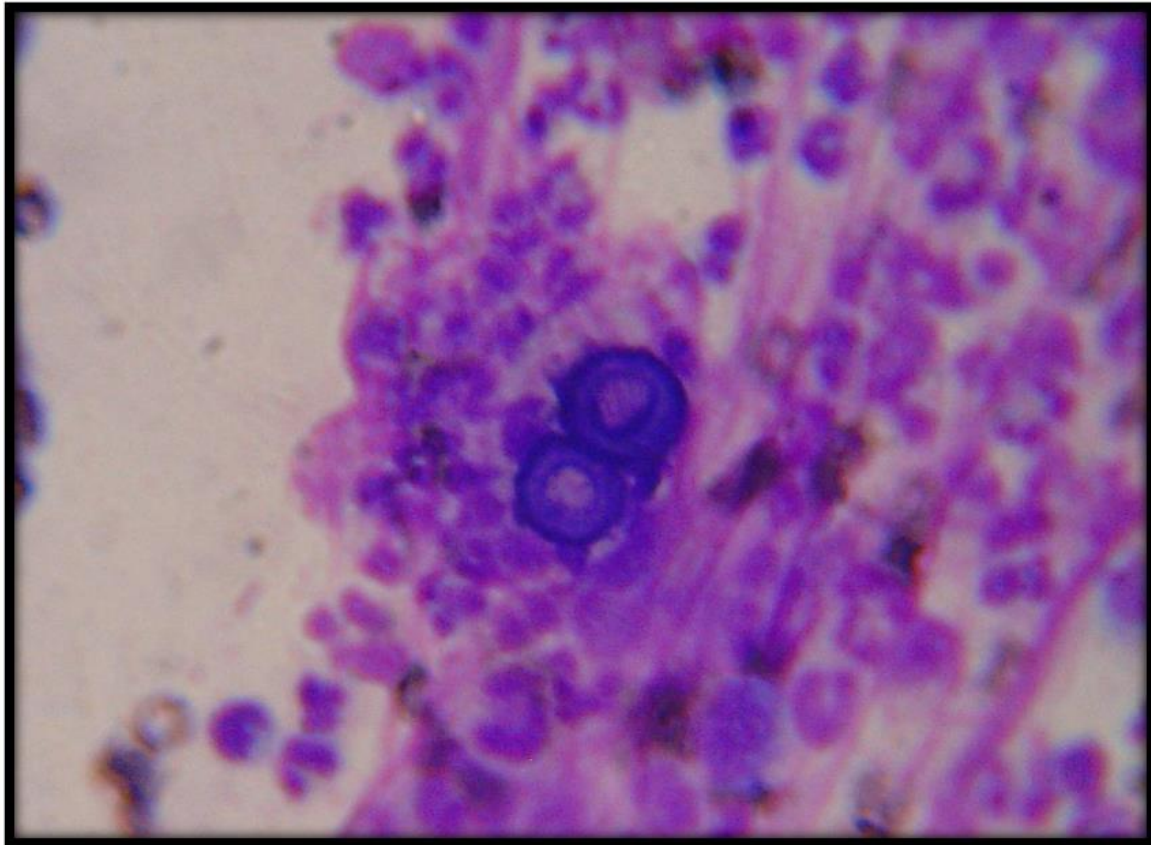


Fig. 1: *Blastomyces dermatitidis* (Hussain *et al.*, 2018).

A Brief Summary of *Blastomyces dermatitidis*:

The inflamed skin bud was called the causative agent of blastomycosis in general. And over the years I think that this nomenclature from a taxonomic point of view is incorrect and I took many synonyms that were all rejected and kept the old designation. dogs are the most vulnerable animal after humans (Bander *et al.*, 2015); (Hussain *et al.*, 2018). Therefore, it was used as a human substitute in epidemiological studies (Bander *et al.*, 2015); (Hussain *et al.*, 2018); (Dahham *et al.*, 2019).

As mentioned above, the lung is considered the gateway to infection for

breakfast bud and there are no reports of transmission from person to person be the one that spoke about the transmission of the disease between two young people working in one place.

The possibility that the two young men have been exposed to the same pathogen is also possible.

It is also reported that two reports of the transmission of flanking inflamed skin via the placenta. As shown in Figure (2) Fungus under the microscope for the skin form of the disease as a result of accidental injection as a dog bite or the wrong exposure to the causative agent during autopsy (Hussain *et al.*, 2018).



Fig.2: Fungus under the microscope (Abdulbaqi *et al.*, 2018).

Blastomycosis was first described in 1894 by scientist Gilchrist in a patient with a skin injury. Initially, it was thought that it was the result of a tuberculosis-skin disease, as it was common at the time, but the histological examination showed the presence of multiple foreign bodies instead of the TB bacillus (Ibrahim *et al.*, 2017).

Then he published his second report in which he explained that the causative factor is the result of what is known as breakfast, which is a general term used at that time to refer to yeasts (Hussain *et al.*, 2019).

knowing the environment of the causative agent is very important in understanding the epidemiology of this fungus

(Turner *et al.*, 2016) ; (Young *et al.*, 2000) (Furculow *et al.*, 2011)

. In spite of the early discovery of Burmese fungi, it was not specified the environments in which it could be found, the availability of some evidence and reports on it made it possible to determine its whereabouts of it (Klein *et al.*, 2017).

In 1961, the bud, inflamed skin, was isolated from the soil and contained some tobacco and organic waste in America Denton / 1126. However, it was concluded that the place of isolation was an old house of a dog with Burmese breakfast (Abdulbaqi *et al.*, 2018).

The Identity of The Inflamed with The Skin, Is Determined Using Several Morphological Properties:

1. Transformation in Tubes:

As these fungi are transformed from the filamentous form that is located at a temperature of 25-30 ° C (on the subordinate glucose agar) to the fermented form on a nutrient medium (Klein *et al.*, 2008) (such as the infusion of the brain and the heart containing 5% blood) at 37 ° C within 3-5 days. It can also be transformed from the yeast shape to the filiform shape under the same conditions (Hussain *et al.*, 2017).

2. The Filiform Shape:

In cultures: inflamed skin bud budsea colonies need 2-4 weeks at the 25th streptococcus degree to grow on the sabboard glucose agar culture when isolated from clinical samples. Typical colonies are white, airy, and cotton fungal strings (Klein *et al.*, 2014). They are either flat or convex as a result of gathering fungal strings. Colonies are white at the beginning of growth and may later turn brown or light brown. He also sees concentrated episodes of growth in the old colonies (4-8 weeks) (Hussain *et al.*, 2019).

Under the microscope: Both breakfast and non-sexual spores appear. The strings are 6-7 micrometers thin, transparent, branched, and partitioned. Creating new growths on top of the threads .whereas,

single-cell spores are borne on thin, lateral, or direct stools on the strings. It also takes the oval to a circular shape with smooth walls and diameters of 3-7. m. It should be noted that the bud, inflamed skin, cannot be diagnosed only on the basis of the shape of the spores due to its similarity with many other types (Abdulbaqi *et al.*, 2018)

3. Yeast Form:

Also known as the histological form, the colonies appear in the form of soft, brain-shaped colonies that look like butter and brown. Under the microscope: Yeasts appear 8-12 micro m in diameter and with a thick

wall (often referred to as a double wall) with a single broad-based bud present when in contact with the parent cell. in an electron microscope, yeasts appear to contain 2-4 nuclei per cell, with a two-layer wall between them, with a transparent area as shown in Figure (3) A, B, and C Diagnosis of mycosis fungoides (Klein *et al.*, 2013) .

Diagnosis of Macrophages:

Blastomycosis is easily diagnosed by extracting samples from the affected organ and examining it with a microscope or by culture.

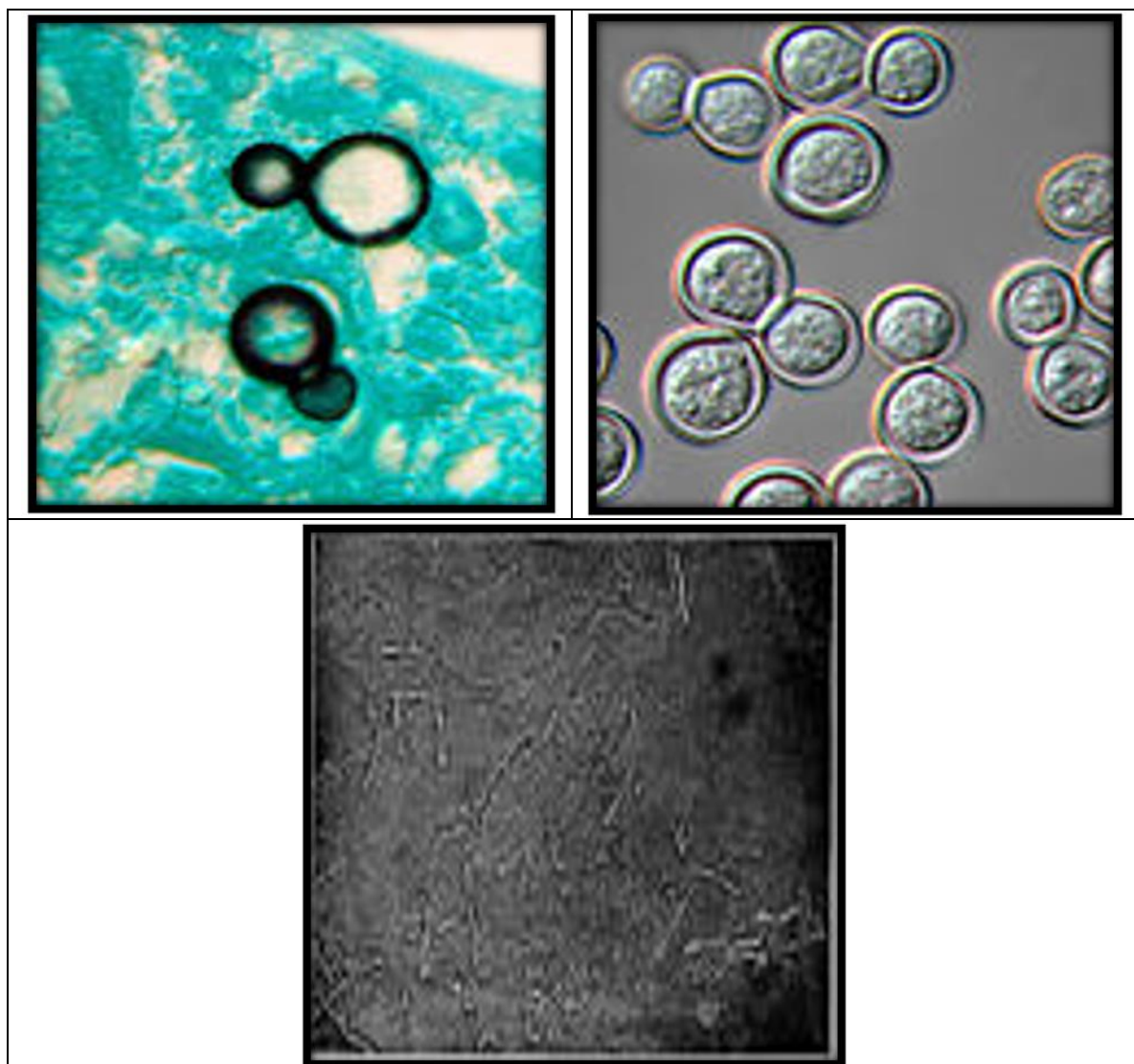


Fig. 3: A, B, C Diagnosis of mycosis fungoides (Ibrahim *et al.*, 2017).

Serologic tests are not effective for the diagnosis of blastomycosis and are used primarily for epidemiological reasons. The doctor diagnoses blastomycosis by sending a sample of infected sputum or tissue to the laboratory for examination under a microscope and culture, and the chest x-ray is imaged to check for signs of infection in the lungs (Cox *et al.*, 2014).

Doctors may also examine a sample of urine to check for proteins (antigens) released by fungi.

Blastomyces dermatitidis Treatment:

If the *Blastomyces Dermatitidis* is severe, it is treated with intravenous

amphotericin B, and if the condition ranges from mild to moderate, then oral itraconazole is administered as shown in Table (1) Types of fungi and treatments.

The treatment improves the patient's condition rather quickly, but the treatment period should last for 6 to 12 months. Untreated, mycosis fungi slowly worsen, and in rare cases can be fatal (Hall *et al.*, 2001; Deighton *et al.*, 2005).

The main drug for treating mycosis is Itraconazole, which belongs to the Azoles family (Dheeb *et al.*, 2019).

Table 1: Types of fungi and treatments (Abdulbaqi *et al.*, 2018).

Mycoses of the Skin				
Disease	Pathogen	Signs and Symptoms	Transmission	Antimicrobial Drugs
Aspergillosis (cutaneous)	<i>Aspergillus fumigatus</i> , <i>Aspergillus flavus</i>	Distinctive eschars at site(s) of infection	Entry via wound (primary cutaneous aspergillosis) or via the respiratory system (secondary cutaneous aspergillosis); commonly a hospital-acquired infection	Itraconazole, voriconazole, amphotericin B
Candidiasis (cutaneous)	<i>Candida albicans</i>	Intertrigo, localized rash, yellowing of nails	Overgrowth of normal skin microbiota, especially in moist, dark areas	Azoles
Sporotrichosis (rose gardener's disease)	<i>Sporothrix schenckii</i>	Subcutaneous ulcers and abscesses; may spread to a large area, e.g., hand or arm	Entry via thorn prick or other wound	Itraconazole
Tineas	<i>Trichophyton</i> spp., <i>Epidermophyton</i> spp., <i>Microsporum</i> spp.	Itchy, ring-like lesions (ringworm) at sites of infection	Contact with dermatophytic fungi, especially in warm, moist environments conducive to fungal growth	Terbinafine, miconazole, clotrimazole, griseofulvin

In the event that there is a risk to the patient's life, mycosis is treated with amphotericin B. Fungi are eukaryotic organisms belonging to the fungi kingdom, which require interaction with another organism to survive, the risk factors for this infection are humidity, the presence of fats in the body and the immune system. Caused by

Blastomyces dermatitidis Systemic diphosphate (Klein *et al.*, 2008).

Body Immunity:

Most fungi are highly immunogenic and generate significant antibody and T cell-mediated immune responses (Cox *et al.*, 2011), which may be identified by serology and delayed-type (type IV) hypersensitivity

skin reactions. T cell-mediated immunity is essential for fungus resistance (Klein *et al.*, 2009).

TH1 T cells and macrophage activation, rather than antibody-mediated responses, are thought to have the most important protective function (Hall *et al.*, 2001; Deighton *et al.*, 2005). Type 1 (T1) reliant cell-mediated immunity, which can be mediated by CD4 and CD8 T cells, is required for protection against infections with dimorphic fungi such *Blastomyces dermatitidis* (Cox *et al.*, 2017). Resistance by both T cell subsets requires the production of T1 cytokines, particularly IFN- γ and TNF- α . IL-12 induces IFN- γ production from T and NK cells, promotes the differentiation of T1 cells from naive T cells, and therefore regulates cell-mediated immunity against fungal and parasitic diseases (Cox *et al.*, 2011).

Resistance to most pathogenic fungi and most systemic mycoses including *B. dermatitidis* is clearly dependent upon T cell-mediated immunity, particularly CD4 TH1 cells secreting IFN γ , dendritic cells are necessary for this response and produce IL-12, after engulfing fungi (Hussain *et al.*, 2017).

CONCLUSION

Clinically, dermatophytes may be confused with spinal keratoma, squamous cell carcinoma, tuberculosis, tertiary syphilis, leprosy, or bacterial pyoderma. Skin symptoms occur in about 80% of people with fungi. They look like warts and may vary from gray to purple, and blisters that blister bleeds easily, over time these lesions can lead to scarring and loss of skin color.

Through a review conducted of several reports about the occurrence of blastomycosis infection, it was found that there was no correlation between the occurrence of the disease and the seasonal period. Also, arriving at a correct judgment of the relationship between time and infection is very difficult, perhaps due to the skin lesions that can appear at different times after the initial infection (Lancaster *et al.*, 2004). Also, the pulmonary infection can be invisible or

not distinguished, and it can be long before the diagnosis.

It was concluded that there was no relationship between infection, profession, or hobby of a person with Burma's disease. But it can be said that the relationship is between infection and a person's presence in a possible environment for infection (Bradsher *et al.*, 2003) (Lancaster *et al.*, 2004). There is no relationship between age, gender, or race, and the incidence of infection (Thurmond *et al.*, 2019). But considering that men's occupations are more likely to be present in infection-causing places, the percentage of men's infections is more than for women.

REFERENCES

- Abdulbaqi, N. J. and Dheeb, B. I. and Irshad, R. (2018). Expression of Biotransformation and Antioxidant Genes in the Liver of Albino Mice after Exposure to Aflatoxin B1 and an Antioxidant Sourced from Turmeric (*Curcuma longa*). *Jordan Journal of Biological Sciences*, 11(2) 89 – 93.
- Al-Tekreeti, A. R., Al-Halbosi, M. M. F., Dheeb, B. I., Hashim, A. J. and Al-Zuhairi, A. F. H. (2017). Molecular identification of clinical *Candida* isolates by simple and randomly amplified polymorphic DNA-PCR. *Arabian Journal for Science and Engineering (AJSE)*, DOI 10.1007/s13369-017-2762-1.
- Bander, K. I., Mohammed, S. H., Thalij, K. M. and Dheeb, B.I. (2015). Survey Study of the allergic Fungi in Kirkuk Area and Use Molecular Detection for Identification. *The International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 19(1):383-397.
- Bradsher R.W. 2003: Development of specific immunity in patients with pulmonary or extrapulmonary blastomycosis. *American Review of Respiratory Disease*, 129:430–434, PubMed Google Scholar.
- Bradsher R.W., Alford R.H. 2002: *Blastomyces dermatitidis*

- antigen-induced lymphocyte reactivity in human blastomycosis. *Infection and Immunity*, 33:485–490, PubMed Google Scholar.
- Cox R.A. 2014: Cross reactivity between antigens of *Coccidioides immitis*, *Histoplasma capsulatum* and *Blastomyces dermatitidis* in lymphocyte transformation assays. *Infection and Immunity*, 25: 932–938, PubMed Google Scholar.
- Cox R.A., Larsh H.W. 2011: Isolation of skin test active preparations from yeast-phase cells of *Blastomyces dermatitidis*. *Infection and Immunity*, 10:42–47, PubMed Google Scholar.
- Cox R.A., Larsh H.W. 2017: Yeast and mycelial-phase antigens of *Blastomyces dermatitidis*: Comparison using disc gel electrophoresis. *Infection and Immunity*, 10:48–53, PubMed Google Scholar.
- Dahham, MT, Omar, AF, Dheeb BI. (2019). Synergistic effect of tea tree oil on fungi causing vaginal thrush in pregnant women. *Journal of Biotechnology Research Center*, 13 (2)35-44.
- Deighton F., Cox R.A., Hall N.K., et al. 2005. In vivo and in vitro cell-mediated immune responses to a cell wall antigen of *Blastomyces dermatitidis*. *Infection and Immunity*, 15:429–435, PubMed Google Scholar.
- Dheeb B.I., Al-dujayli S.M.A., Ibrahim I.M., Abbas Q.A. (2019). Study the Antifungal Activity of ZnS: Mn Nanoparticles Against Some Isolated Pathogenic Fungi. *Journal of Physics: Conference Series*, 1178, 46–52.
- Furculow M.L., Chick E.W., Busey J.D., et al. 1970: Prevalence and incidence studies of human and canine blastomycosis. I. Cases in the United States, 1885–2005. *American Review of Respiratory Disease*, 102:6067, Google Scholar
- Green J.H., Harrell W.K., Johnson J.E., et al. 2002: Isolation of an antigen from *Blastomyces dermatitidis* that is specific for the diagnosis of blastomycosis. *Current Microbiology*, 4:293–296, CrossRef Google Scholar
- Hall N.K., Deighton F., Larsh H.W. 2001: Use of an alkali-soluble water-soluble extract of *Blastomyces dermatitidis* yeast-phase cell walls and is electrically focused components in peripheral lymphocyte transformation. *Infection and Immunity*, 19:411–415, PubMed Google Scholar.
- Hussain A.F., Sulaiman G.M., Dheeb B.I., Hashim A.J. (2018). Histopathological changes and expression of transforming growth factor-beta (TGF- β 3) in mice exposed to gliotoxin. *Journal of K S U – Science*, 27, 193–197.12.
- Hussain, A. F., Sulaiman, G. M., Dheeb, B. I., Hashim, A. J. and Seddiq, S. H. (2017). Improving conditions for gliotoxin production by local isolates of *Aspergillus fumigatus*. *Journal of biotechnology research center*. 11(2):14-24.
- Hussein, H.S., Dheeb B.I., Hamada, T.A. (2019). Studying the candida resistance and sensitivity for some antifungals. *Journal of Biotechnology Research Center*, 13 (2)25-34.
- Ibrahim, I. M., Iftikhar, M., Ali, I. M., Dheeb, B. I., Abbas, Q. A., Ramizy, A., Eisa, M. H. and Aljameel, A. I. (2017). Antifungal activity of wide bandgap Thioglycolic acid capped ZnS: Mn semiconductor nanoparticles against some pathogenic fungi. (2017). *Materials Science and Engineering*, C 73:665–669.
- Kaufman L., McLaughlin D.W., Clark M.J., et al. 2001: Specific

- immunodiffusion test for blastomycosis. *Journal of Applied Microbiology*, 26:244–247, PubMed Google Scholar
- Klein B.S., Bradsher R.W., Vergeront J.M., *et al.* (2009). The development of long-term specific cellular immunity after acute *Blastomyces dermatitidis* infection: Assessments following a large point-source outbreak in Wisconsin. *Journal of the Infectious Diseases*, 191:97–101, PubMed CrossRef Google Scholar.
- Klein B.S., Jones J.M. 2014: Isolation, purification and radiolabeling of a novel 120 kD surface protein on *Blastomyces dermatitidis* yeasts to detect antibody in infected patients. *Journal of Clinical Investigation*, 124:152–161, PubMed CrossRef Google Scholar
- Klein B.S., Kuritsky H.N., Chappel W.A., *et al.* 2013: Comparison of the enzyme immunoassay, immunodiffusion and complement fixation tests in detecting antibody in human sera to the A antigen of *Blastomyces dermatitidis*. *American Review of Respiratory Disease*, 177:144–148, PubMed Google Scholar
- Klein B.S., Vergeront J.M., Kaufman L., *et al.* 2017: Serological tests for blastomycosis: Assessment during a large point-source outbreak in Wisconsin. *Journal of the Infectious Diseases*, 215:262–268, PubMed CrossRef Google Scholar
- Klein B.S., Vergeront J.M., Weeks R.I., *et al.* 2008. Isolation of *Blastomyces dermatitidis* in soil associated with a large outbreak of blastomycosis in Wisconsin. *New England Journal of Medicine (NEJM)*, 314:529–534, PubMed CrossRef Google Scholar
- Lancaster M.V., Sprouse R.F. 2004: Isolation of a purified skin test antigen from *Blastomyces dermatitidis* yeast-phase cell wall. *Infection and Immunity*, 14:623–625, PubMed Google Scholar.
- Thurmond L.M., Mitchell T.G. (2019). *Blastomyces dermatitidis* chemotactic factor: Kinetics of production and biological characterization evaluated by a modified neutrophil chemotaxis assay. *Infection and Immunity*, 127:87–93, PubMed Google Scholar
- Turner S.H., Kaufman L., Jalbert M. 2016: Diagnostic assessment of an enzyme-linked immunosorbent assay for human and canine blastomycosis. *Journal of Clinical Microbiology*, 154:294–297, PubMed Google Scholar.
- Young K.D., Larsh H.W. 2000: Identification of the active precipitin components in a purified preparation of the A antigen of *Blastomyces dermatitidis*. *Infection and Immunity*, 68:171–177, PubMed Google Scholar.