DOI https://doi.org/10.30525/978-9934-26-657-7-17

SENSITIVITY OF RABBIT'S OPPORTUNISTIC *CANDIDA* NON-*ALBICANS* TO ANTIFUNGALS IN THE ASPECT OF PUBLIC HEALTH

ЧУТЛИВІСТЬ УМОВНО-ПАТОГЕННОГО *CANDIDA* NON-*ALBICANS* КРОЛИКІВ ДО ПРОТИГРИБКОВИХ ПРЕПАРАТІВ З ТОЧКИ ЗОРУ ГРОМАДСЬКОГО ЗДОРОВ'Я

Pikhtirova A. V.
Candidate of Veterinary Sciences,
Associate Professor,
Scientific laboratory of PCR diagnostics
Sumy National Agrarian University;
Department of Public Health
Sumy State University
Sumy, Ukraine

Піхтірова А. В.
кандидат ветеринарних наук,
доцент,
Наукова лабораторія ПЛР-діагностики
Сумський національний аграрний університет;
кафедра громадського здоров'я
Сумський державний університет
м. Суми, Україна

Shkromada O. I.
Doctor of Veterinary Sciences,
Professor,
Scientific laboratory of PCR diagnostics
Sumy National Agrarian University
Sumy, Ukraine

Шкромада О. І.
доктор ветеринарних наук,
професор,
Наукова лабораторія ПЛР-діагностики
Сумський національний аграрний університет
м. Суми, Україна

Varenyk L. V.
Candidate of Veterinary Sciences,
Scientific laboratory of PCR diagnostics
Sumy National Agrarian University
Sumy, Ukraine

Вареник Л. В.
кандидат ветеринарних наук,
Наукова лабораторія ПЛР-діагностики
Сумський національний аграрний університет
м. Суми, Україна

The nature of infectious diseases has changed significantly in recent decades. Fungi, which until recently were considered less virulent and non-pathogenic, are now one of the main causes of morbidity and mortality in immunocompromised individuals. Until "yesterday" the predominant cause of candidiasis was *Candida albicans*. However, recently there has been a shift towards *Candida* spp. belonging to the non-*albicans* group

(NAC). These *Candida* spp. show reduced susceptibility to common antifungal drugs [1].

For today, more than 18 different *Candida* spp. have been identified as a causative agent of infections in humans and animals, but at least 6 of them are associated with more than 95% of invasive diseases [2]. Although the majority of candidiasis cases are still caused by *C. albicans* (63–70%) [3], other *Candida* spp., such as *Candida tropicalis*, *Candida parapsilosis*, *Pichia kudriavzevii*, *Nakaseomyces glabrata*, and *Candida auris*, are as important in clinical settings as *C. albicans* and are known as NAC. They are commonly found in the environment, on the skin, or as colonizers of mucous membranes in humans and animals [4] and, under susceptible conditions, can cause disease or complicate the course of the primary disease.

Since these NAC are quite resistant in the environment and show reduced sensitivity to the action of antifungal drugs, we decided to test the effectiveness of the the most common fungicidals.

Materials and methods. The material for the study (feces) was collected in the morning (immediately after defecation) from 30 clinically healthy animals. The samples were transported to the laboratory in a thermal bag immediately after collection in sterile containers for biological fluids (30 ml, URI-BOX, F.L. MEDICAL S.R.L., Italy).

Rabbits of Californian breed (*Oryctolagus cuniculus*), 3-4 months of age are kept in cages in groups of 5–6 animals in compliance with appropriate conditions. The diet of the animals consists of: alfalfa hay, grain mixture (oats, barley) and mineral-vitamin supplement. Rabbits have free access to water. The temperature in the room where the cages are placed +17–18 °C.

Cultural studies were conducted at the Scientific Laboratory of PCR diagnostics SNAU and the Microbiological Laboratory of the SE Medical Institute of Sumy State University. In order to isolate a pure culture of fungi, rabbit feces samples were previously added to nutrient broth (NB) and incubated at 37°C. After 5 hours of incubation, the NB was filtered and inoculated using the streak plate method onto a differential diagnostic medium for fungi – Sabouraud agar (SA) manufactured by "Pharmaktiv" LLC (Ukraine). Then the Petri dishes were placed in a thermostat at 37°C for 48 hours. After that, the fungi were identified using standard methods based on morphological, tinctorial, cultural and biochemical properties [5].

Determination of the sensitivity of the isolated fungi to antifungal drugs was carried out by the disco-diffusion method [6]. For this purpose, the fungal culture was sown by the lawn method in standard Petri dishes (90-mm circular plate) on Mueller-Hinton medium ("Pharmaktiv" LLC, Ukraine) and 5 paper discs impregnated with fungicides were placed on each: ketoconazole 10 μg (KT 10), itraconazole 30 μg (IT 30), miconazole 50 μg (MIC 50), pimafucin 50 μg (PM 50) and nystatin 100 μg (NS 100) manufactured by "Pharmaktiv" LLC (Ukraine). Petri dishes were incubated for 48 hours at 37°C, after which the results were calculated. The sensitivity of fungi to the indicated antifungal drugs was determined by the diameter of the inhibition zone (IZ) around the disk in mm. Statistical calculations were performed using Microsoft® Excel® 2016.

Results. As a result of cultural examination of fecal samples, growth on CA was noted in all plates. After biochemical studies, the culture was identified as *Candida* non-*albicans*. The identified microorganisms are common inhabitants of the intestinal tract of animals and humans. They are widely distributed in nature – soil, water and on all surfaces. They are also opportunistic pathogens capable of causing disease in immunocompromised individuals.

The results of the study on determining the sensitivity of fungi to commonly used antifungal agents in veterinary and human medicine indicate high sensitivity to IT 30 in the form of IZ at the level of 22±4.0 mm. At the same time, there is a complete lack of sensitivity to KT 10, MIC 50, PM 50 and NS 100, which is of great concern.

The mechanism of KT and IT action is associated with disruption of the biosynthesis of ergosterol, triglycerides and phospholipids. MIC damages fungal cell membranes and disrupts the transformation of yeast fungi into micellar forms. The action of PM and NS consists in irreversible binding to ergosterol in the fungal cell membrane, which destroys its integrity, disrupts permeability, leads to leakage of cellular elements and cell death [7].

Candida spp., that do not belong to albicans, have become an important cause of infection. Their isolation from a clinical specimen can no longer be ignored as a non-proprietary isolate, nor can it be dismissed as a contaminant [8].

Due to the low susceptibility to fungicides, some efforts have been made to develop new effective and safe alternative methods for the treatment of candidiasis. An important aspect is the possibility of using such agents alone or in synergy with traditional antifungals. New bioactive compounds originating from primary and secondary metabolites of various plant species have been identified. Although further studies are currently needed to use these compounds as a treatment for candidiasis, the results obtained in vitro pave the way for exploring their use in clinical settings. In contrast to common drugs, the use of bioactive plant compounds promises greater efficacy and lower toxicity. Bioactive plant compounds may act as anti-Candida agents through the cell wall and membrane changes they induce, particularly by reducing the synthesis of ergosterol and polysaccharides [9].

The development of new therapeutic strategies against different NAC species will contribute to the control of infections caused by these species and will also help reduce the incidence of resistance to common antifungal drugs [8]. Among the problems that need to be solved in this field are the lack of specific chemical structures for some compounds, the development of chemical synthesis to supply the pharmaceutical market, or sustainable isolation directly from plant raw materials.

Funding. This work was funded by the project of the MES of Ukraine "Research into the spread of infectious disease pathogens and antibiotic-resistant microorganisms in frontline areas" (№0126U000393).

Bibliography:

1. Deorukhkar S. C., Saini S., Mathew S. Non-albicans Candida Infection: An Emerging Threat. *Interdisciplinary perspectives on infectious diseases.* 2014. 615958. https://doi.org/10.1155/2014/615958

2. Sardi J. C. O., Scorzoni L., Bernardi T., Fusco-Almeida A. M., Mendes Giannini M. J. S. Candida species: current epidemiology, pathogenicity, biofilm formation, natural antifungal products and new therapeutic options. *Journal of medical microbiology*. 2013. Vol. 62 (1). Pp. 10–24. https://doi.org/10.1099/jmm.0.045054-0

3. Mandras N., Roana J., Scalas D., Del Re S., Cavallo L., Ghisetti V., Tullio V. The Inhibition of Non-*albicans Candida* Species and Uncommon Yeast Pathogens by Selected Essential Oils and Their Major Compounds. *Molecules (Basel, Switzerland)*. 2021. Vol. 26(16), 4937. https://doi.org/10.3390/molecules26164937

4. Enoch D. A., Yang H., Aliyu S. H., Micallef C. The Changing Epidemiology of Invasive Fungal Infections. In: Lion, T. (eds) Human Fungal Pathogen Identification. Methods in Molecular Biology. Humana Press, New York, NY. 2017. Vol. 1508. Pp. 17–65. https://doi.org/10.1007/978-1-4939-6515-1_2

5. Bailey & Scott's Diagnostic Microbiology, 16th Edition / Patricia M. Tille, ISBN Number 9780443118913, Elsevier 2025, 1344 p.

6. The European Committee on Antimicrobial Susceptibility Testing. Routine and extended internal quality control for MIC determination and disk diffusion as recommended by EUCAST. Version 16.0, 2026. http://www.eucast.org

7. https://www.pharmencyclopedia.com.ua/article/3479/ketokonazol

8. Gómez-Gaviria M., Ramírez-Sotelo U., Mora-Montes H. M. Non-*albicans Candida* Species: Immune Response, Evasion Mechanisms, and New Plant-Derived Alternative Therapies. Journal of Fungi. 2023. Vol. 9(1). Pp. 11. https://doi.org/10.3390/jof9010011

9. Guevara-Lora I., Bras G., Karkowska-Kuleta J., González-González M., Ceballos K., Sidlo W., Rapala-Kozik M. Plant-Derived Substances in the Fight Against Infections Caused by *Candida* Species. *International Journal of Molecular Sciences.* 2020. Vol. 21(17), 6131. https://doi.org/10.3390/ijms21176131

DOI https://doi.org/10.30525/978-9934-26-657-7-18

ANIMAL WELFARE AS A COMPONENT OF ENSURING FOOD SECURITY

ДОБРОБУТ ТВАРИН ЯК СКЛАДОВА ЗАБЕЗПЕЧЕННЯ ПРОДОВОЛЬЧОЇ БЕЗПЕКИ

Ulko L. G.
Doctor of Veterinary Sciences,
Professor at the Departments of Internal Medicine, Pharmacy and Biochemistry
Sumy National Agrarian University
Sumy, Ukraine

Улько Л. Г.
доктор ветеринарних наук,
професор кафедри внутрішніх хвороб, фармації та біохімії
Сумський національний аграрний університет
м. Суми, Україна

Nikitina D. Ye.
Postgraduate Student at the Department of Internal Medicine, Pharmacy and Biochemistry
Sumy National Agrarian University
Sumy, Ukraine

Нікітіна Д. Є.
аспірантка кафедри внутрішніх хвороб, фармації та біохімії
Сумський національний аграрний університет
м. Суми, Україна

Добробут тварин є невід'ємною складовою майбутнього сталого сільського господарства та Цілей сталого розвитку ООН. Ветеринарні служби, що охоплюють державних і приватних ветеринарних лікарів є його хранителями і ключовими учасниками майбутніх заходів із його поліпшення[1]. Він є частиною загальної «концепції якості харчових продуктів», при цьому зростає усвідомлення зв'язку між станом добробуту тварин та безпекою харчових продуктів.

Згідно з визначенням World Organisation for Animal Health (WOAH), добробут – це фізичний і психічний стан тварини, на який впливають умови в яких вона живе та помирає[3]. Він ґрунтується на принципі, що до тварини слід ставитися так, щоб задовольняти її біологічні, поведінкові та емоційні потреби, забезпечуючи належну якість життя.