



UNIwersytet  
PRZYRODNICZY  
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SZKOŁA DOKTORSKA  
WYDZIAŁ MEDYCYNY WETERYNARYJNEJ  
KATEDRA EPIZOOTIOLOGII Z KLINIKĄ PTAKÓW I ZWIERZĄT EGZOTYCZNYCH

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**Charakterystyka epidemiologiczna gronkowców izolowanych  
od ludzi oraz psów i kotów, ze szczególnym uwzględnieniem  
*Staphylococcus aureus* i *Staphylococcus pseudintermedius***

Promotorzy

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Wrocław 2023

## Abstract

An alarming increase of antibiotic resistance in bacteria is observed both in human and veterinary medicine. The lack of effective antibiotic therapy has become a serious problem in recent years. This problem affects many genera of bacteria, including staphylococci (*Staphylococcus spp.*) - ubiquitous, Gram-positive cocci. Most of them belong to the opportunistic microbiota that inhabit the skin and mucous membranes of humans and animals. It is believed that the most significant risk to humans and animals is associated with carrying of coagulase-positive staphylococci (CoPS) - *Staphylococcus aureus* (*S. aureus*) and *Staphylococcus pseudintermedius* (*S. pseudintermedius*), while coagulase-negative staphylococci (CoNS) were considered exclusively as non-pathogenic species or environmental contamination of the sample. While CoPS, especially *Staphylococcus aureus*, are well known, the knowledge of the coagulase-negative staphylococci is still rather limited. In recent years, there has been an increase in the importance of CoNS in the clinical aspect, due to severe infections caused by these bacteria in humans and animals.

Therefore, the aim of the study was the epidemiological characterization of staphylococci isolated from humans and companion animals, species identification of the obtained bacterial strains using modern methods, such as mass spectrometry, the MALDI-TOF MS method with additional genotyping of selected strains using advanced molecular methods along with the assessment of their drug resistance. More narrowly, the aim was to determine methicillin resistance at the genetic and phenotypic level, as well as to determine the *spa* types of the tested strains of *S. aureus*. An additional aspect of the project was a survey, from which information on the characteristics of the study groups, working and living environment, and other potential risk factors for colonization by staphylococci was obtained.

The study material consists of bacteriological swabs taken from humans and dogs and cats. From every person, the swabs from the skin behind the auricle and in the elbow bend, nasal atrium and oral cavity were taken. The material from animals was collected from the external auditory canal, conjunctival sac, nasal atrium, oral atrium, skin in the groin, rectum and possible wounds or skin lesions (if present). The people and animal owners were asked to complete questionnaires in which they were asked about personal characteristics, treatment in the last 12 months (including cases of hospitalization and antibiotic therapy), the possibility of contact with animals, as well as the environmental conditions in which the tested people and animals live. To identify the species of the obtained bacterial strains, a bacteriological test, a coagulase tube test and MALDI-TOF MS method were performed. Species affiliation of *S. aureus* and *S. pseudintermedius* was confirmed by detection of *nuc*, *spa* and *pta* genes, respectively, using the PCR-RFLP method in accordance with the guidelines of the literature.

The drug susceptibility of *Staphylococcus spp.* strains at the phenotypic level was determined using the disc diffusion and MIC methods based on the CLSI standards. Genetic determinants of resistance of selected groups of antimicrobial chemotherapeutics were detected by PCR. Methicillin resistance of CoNS strains derived from animals was also tested using the MIC method.

161 cats, 113 dogs and 261 people participated in the study, and 165 strains of *S. pseudintermedius*, 202 strains of *S. aureus* and 413 strains of CoNS were selected to detailed laboratory analyses. The most frequently isolated staphylococcal species were *S. epidermidis* and *S. aureus* from humans, *S. felis* and *S. epidermidis* from cats, and *S. pseudintermedius* and *S. epidermidis* from dogs. Among the tested CoPS isolates, resistance to penicillin, ampicillin, clindamycin, erythromycin, and amoxicillin with clavulanic acid prevailed. The isolation rate of methicillin-resistant staphylococci was visibly higher for CoNS (18%) than for CoPS (2%). A significant percentage (nearly 16%) of *S. aureus* and *S. pseudintermedius* strains were also found to contain the *vanA* and *vanB* genes. Statistical analysis of the data obtained from the surveys showed that among the significant risk factors of colonization of testes people and animals by staphylococci, one should mention, among others: exposure to the medical environment (both as job and as a patient), treatment in the previous year (including antimicrobial treatments) and contact with animals (in professional and private life).

The results of the conducted own research are formulated conclusions, which are answers to the research questions, but also practical implications. It has been confirmed that staphylococci commonly colonize humans and animals, and the described drug resistance is a guideline for clinicians when making therapeutic decisions. The high percentage of methicillin-resistant CoNS strains in animals is alarming given the frequency and proximity of human contact with companion animals. Understanding the risk factors of colonization of humans, dogs and cats by staphylococci allows for the development and implementation of educational and preventive measures.