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# Aggregation and biofilm formation of mono- and co-culture *Candida* species and *Staphylococcus aureus* are affected by nutrients in growth media

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# Abstract

*Candida* species and *Staphylococcus aureus* coexist in nosocomial infections. These interkingdom interactions are associated with oral biofilm formation, leading to various oral diseases. This study elucidated the interkingdom interactions of these microorganisms, particularly their aggregation and biofilm formation, in three different media. *Candida auris*, *Candida albicans*, *Candida lusitanae*, *Candida dubliniensis*, *Candida parapsilosis*, *Candida glabrata* and *S. aureus* were used in this study. Aggregation assays were conducted to determine planktonic interaction, and biofilm assays were performed to investigate intra- and interkingdom interactions in a static biofilm environment. Most *Candida* spp. exhibited a high auto-aggregation percentage in brain heart infusion broth supplemented with yeast extract (BHIYE). In addition, co-culture biofilm with *S. aureus* significantly reduced the total cell counts of *Candida* spp. compared to mono-culture ( $p < 0.05$ ). In conclusion, co-aggregation, biofilm biomass and total cell count were species- and growth medium-dependent, and *S. aureus* interacted antagonistically with *Candida* spp. © 2025 Informa UK Limited, trading as Taylor & Francis Group.

## Author keywords

aggregation; biofilm; *Candida*; co-infections; growth media; Interkingdom interactions

## Indexed keywords

### MeSH

Biofilms; Biomass; *Candida*; Coculture Techniques; Culture Media; Microbial Interactions; Nutrients; *Staphylococcus aureus*

### GEOBASE Subject Index

bacterium; biofilm; biomass; fungus; infectious disease; monoculture; nutrient dynamics; yeast

### EMTREE medical terms

biofilm; biomass; *Candida*; chemistry; coculture; culture medium; growth, development and aging; microbial interaction; nutrient; pharmacology; physiology; *Staphylococcus aureus*

## Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

Culture Media