

# Microbial Dynamics of the Foot: Transition from Commensal Flora to Infection

Members: Sarah Salman, Insha Hassan, Tehreem Hafsa, Akasha Mukhtiar, Farheen Azeemi, Umema Muhammad Naeem

## Core message

The foot microbiome is a unique niche of bacteria & fungi. In a healthy state, commensals (e.g., *Staphylococcus*, *Aspergillus*) protect against pathogens. However, microbial imbalance triggers transition from stable flora to clinical infection, this process is known as dysbiosis.

Don't let it slide, keep the Biome on your side!

## Tips For A Healthy Foot Microbiome

-  Wash daily (mild soap, lukewarm water)
-  Dry thoroughly; wear breathable shoes & socks
-  Moisturize (fragrance-free) to prevent cracks
-  Trim nails straight across
-  Wear properly fitted, supportive footwear

## Pathogenesis

### Normal Microbial Balance

#### Triggers For Shift

Environmental factors (moisture, warmth, occlusive footwear, etc) disrupt balance. This results in commensals becoming opportunistic pathogens.

### Did you know?

Your foot microbiome is uniquely yours! it's almost as individual as a fingerprint.

### Bacterial Pathogenesis Adherence & Colonization

Bacteria attach to skin using adhesins, establishing a foothold before invading or forming biofilms.

#### Tissue Invasion

Bacterial enzymes (hyaluronidase, collagenase, kinases) break down skin and connective tissue to penetrate and establish infection.

#### Immune Evasion

Capsules, protein A, biofilm, and toxins help bacteria avoid immune detection and persist on skin.

### Fungal Pathogenesis Adherence to keratinized skin

Spores attach to stratum corneum, establishing a foothold for growth.

#### Keratin Degradation

Keratinases and proteases (from fungi) break down keratin, allowing penetration and nutrient access.

#### Hyphal Penetration

Fungal hyphae grow into superficial skin layers, spreading across the stratum corneum.

#### Immune Evasion & Persistence

Fungi adapt to low immune surveillance and thrive in moist, warm environments to resist clearance.

### Infection Development

**Bacterial:** Overgrowth of opportunistic bacteria (e.g., *S. aureus*) causes cellulitis, wound infections, and diabetic foot infections.

**Fungal:** Dermatophyte overgrowth (e.g., *Trichophyton rubrum*) causes tinea pedis (athlete's foot), scaling, itching, and fissures.



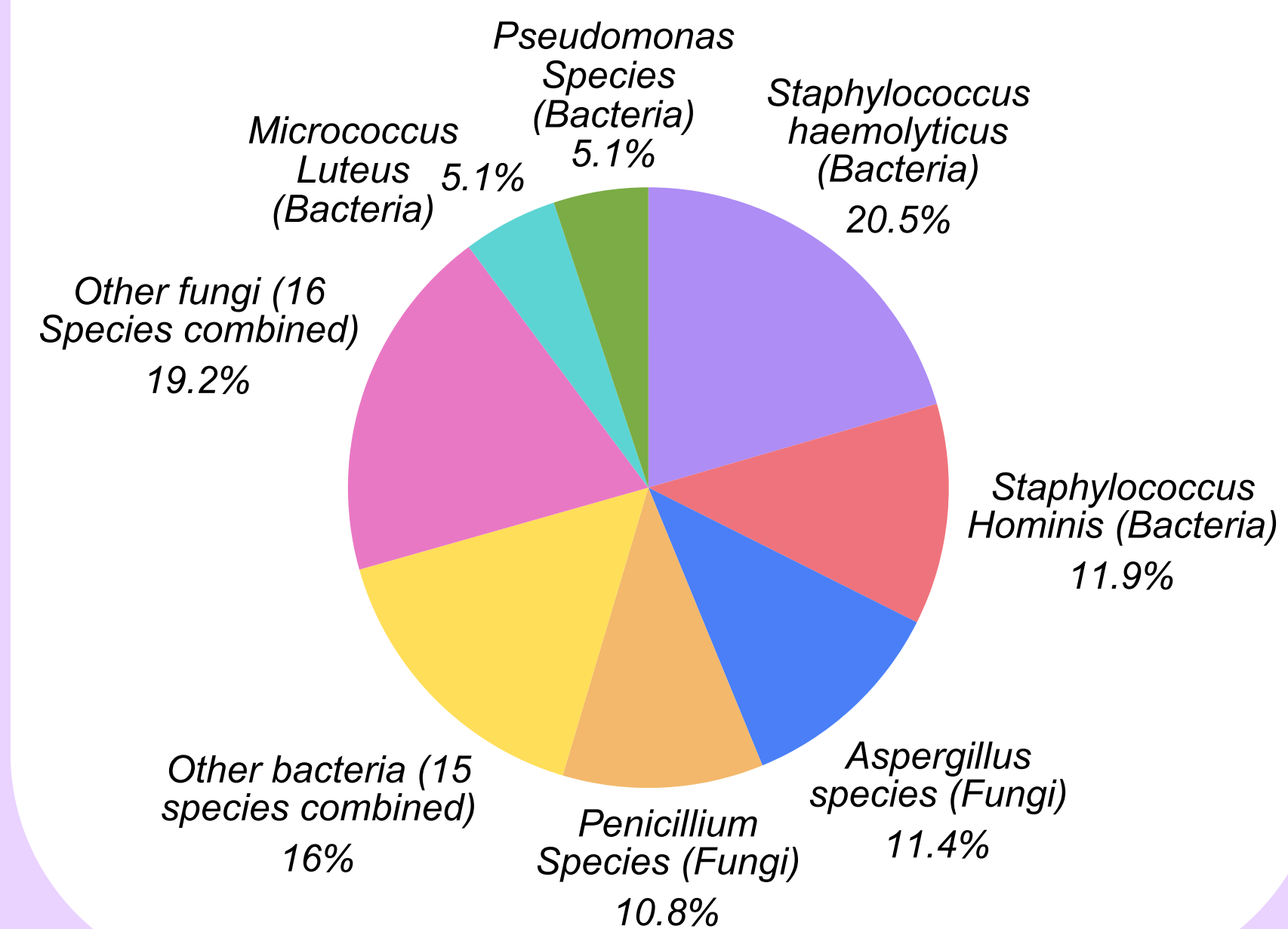
Cellulitis



Tinea pedis

## Case Study

Pie Chart 1. Relative abundance of bacterial and fungal isolates from foot skin. Based on data from Steglińska et al.<sup>2</sup>, Table 3. Percentages represent proportion of total isolates (n = 176) from 40 healthy individuals. Groups <4% combined as "Other."



## Significance

- The feet normally have harmless microbes, but factors like sweat, poor hygiene, or cuts can cause infections.
- This is important in daily life and especially for diabetic patients, as small infections can become serious if untreated.



## References

- Jawetz, Merrick & Adelbergs Medical Microbiology 29th edition
- Steglińska A, et al. (2019). Int J Environ Res Public Health, 16(18), 3503. <https://doi.org/10.3390/ijerph16183503>
- Adamczyk K, et al. (2020). J Cosmet Dermatol, 19(5), 1039–1043. <https://doi.org/10.1111/jocd.13368>