

Action of rough lemon and sicilian lemon on arabica coffee husk fermentation regarding antioxidant, antimicrobial, and probiotic activities

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INTRODUCTION & AIM

Introduction

- Coffee husk: main residue of Brazilian coffee cultivation.
- Rich in bioactive compounds: chlorogenic acids, trigonelline, phenolic compounds.
- Exhibits antioxidant, antimicrobial, and probiotic effects.
- Potential as a natural alternative to synthetic extracts for the food industry.

Aim

- Evaluate the effect of adding:
Rough lemon (*Citrus x limonia*)
Sicilian lemon (*Citrus limon*)
- At different fermentation times (12h, 36h, 60h).
- Enhance bioactive properties of coffee husk.
- Promote sustainable use of coffee residues and additional income for farmers.

METHOD



Sample preparation

- Each treatment was subjected to fermentation at the established times.

Fermentation process

- After fermentation, the husks were dried until reaching 12.35% moisture content (dry basis).

Post-fermentation drying

Microbiological assays

- Antimicrobial activity tests of the husks against microorganisms:
Pathogenic: *Staphylococcus aureus* and *Salmonella enteritidis*;
Probiotic: *Lactobacillus acidophilus*

Physicochemical analyses

- pH;
- Titrateable acidity;
- Phenolic compounds;
- Trigonelline;
- Chlorogenic acids.

- Residue used: coffee husk.
- Treatments:
A: husk + rough lemon
B: coffee husk only
C: husk + Sicilian lemon
- Fermentation times: 12 h (1), 36 h (2), and 60 h (3).
- Nine treatments: (A1, A2, A3, B1, B2, B3, C1, C2, C3).

RESULTS & DISCUSSION

➤ Antimicrobial Effects:

Pathogens (*S. aureus* & *S. enteritidis*): Strong inhibition across all treatments, most potent in groups A, C, and B2. Probiotics (*L. acidophilus*): Growth was not favored in any treatment; a clear inhibitory effect was observed.

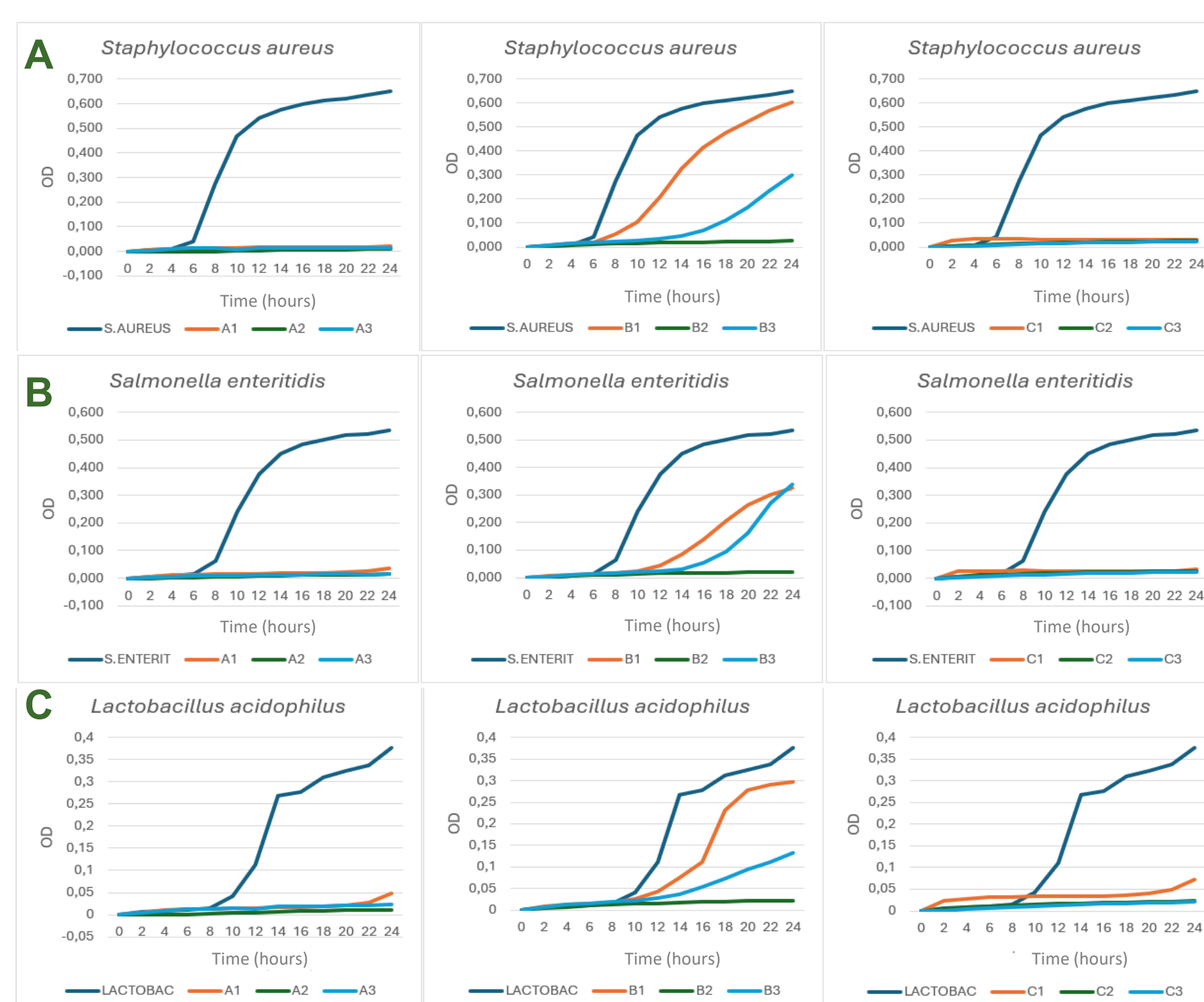


Figure 1. Growth curves of *S. aureus* (A), *S. enteritidis* (B), and *L. acidophilus* (C) during coffee husk fermentation with lemon treatments. **Source:** author

➤ Physicochemical Effects:

Lemon addition rapidly reduced pH and increased titrateable acidity, especially within the first 36 hours.

Treatment B3: Significantly increased phenolic compounds & acidity, enhancing antioxidant activity over time.

Treatment A3: Increased trigonelline, suggesting alternative antioxidant pathway.

Optimal Treatment: C1 (Sicilian lemon, 12h fermentation) showed the best overall results.

CONCLUSION

Fermentation with lemon is a potent strategy for bio-fortifying coffee husks, improving their physicochemical properties and natural antimicrobial capacity. Selecting the right lemon type and timing is key to tailoring extracts for food preservation or nutraceutical applications.

FUTURE WORK / REFERENCES

Cassimiro DMJ, Batista NN, Fonseca HC et al. (2023). Wet fermentation of *Coffea canephora* by lactic acid bacteria and yeasts using the self-induced anaerobic fermentation (SIAF) method enhances the coffee quality. **Food Microbiology**, 110:104161.