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Unimore Microbial Culture Collection: a new challenge in preserving and exploiting microbiomes from fermented beverages

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INTRODUCTION

Unimore Microbial Culture Collection (UMCC) is the infrastructure belonging to the University of Modena and Reggio Emilia and partner of the **SUS-MIRRI.IT** project, which aims to strengthen the Italian Network of Microbial Resources MIRRI.IT. One of the objectives of SUS-MIRRI.IT includes sampling and exploitation of **food microbiomes** [1]. From this perspective, the PhD project focuses on the study of the effectiveness of long-term preservation of microbiomes from fermented beverages. Collected microbiomes, analysed by culture dependent and independent methods, are stored by ultra-freezing and freeze-drying. A comparative study of microbiomes prior and after long-term preservation is carried out to evaluate their industrial exploitation.

MATERIALS AND METHODS

SAMPLES

- Kombucha tea
- Wine vinegar
- Fermented olive mill wastewater

PRESERVATION METHODS

Sample

Ultra-freezing
Sample + 25% (v/v) Glycerol

Freeze-drying
Sample + 10% (w/v) Skim milk

Long-term Preservation
Time (months)
0 4 7 12

REVITALIZATION AND PROPAGATION

Preserved microbiomes

Substrate (Kombucha-tea based or wine or olive mill wastewater)

Product after propagation

☑Microbiological analysis
☑Chemical analysis

RESULTS

KOMBUCHA TEA

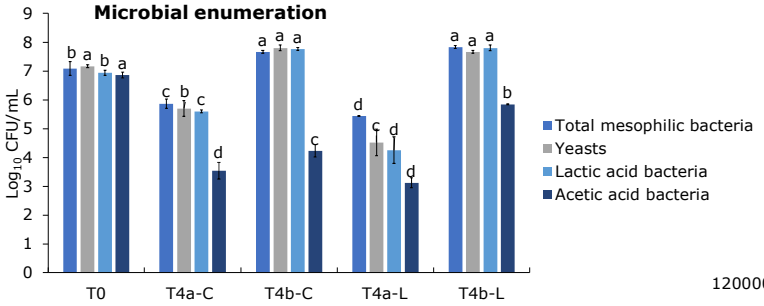

Figure 1: Cultivable microorganisms by plate counts on different solid growth media. Different letters indicate significant differences among the types of cultivable microorganisms (p<0.05)

Sample	pH	%Titratable acidity	°Brix
T0	3.00 ± 0.02a	0.74 ± 0.005a	8.60 ± 0.13a
T4b-C	3.71 ± 0.12a	0.32 ± 0.10a	9.20 ± 0.14a
T4b-L	3.66 ± 0.84a	0.56 ± 0.72a	7.15 ± 2.12a

Table 1: Chemical parameters before storage and after the fermenation process [2]. Different letters in the same column indicate significant differences between preservation methods (p < 0.05)

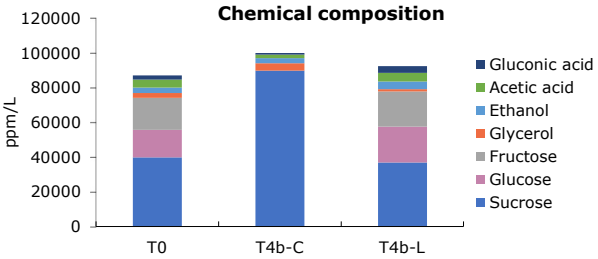

Figure 2: Chemical composition before storage and after propagation by HPLC analysis [2].

Microbiome samples code: T0= before storage; **T4a-C**= cryopreserved for 4 months and revitalized; **T4b-C**= cryopreserved for 4 months, revitalized and propagated; **T4a-L=** freeze-dried preserved for 4 months and revitalized; **T4b-L**= freeze-dried preserved for 4 months, revitalized and propagated.

CONCLUSIONS

The obtained findings demonstrated that kombucha tea microbiomes can be stored through cryopreservation and freeze-drying, preserving their vitality and functionality. The best preservation method was found to be freeze-drying; in fact, the freeze-dried kombucha samples after 4 months of storage were used to ferment kombucha-tea based, obtaining a fermented product with chemical characteristics comparable to the pre-storage kombucha tea. The variation in acetic acid, ethanol and gluconic acid contents might be attributed to differences in the microbial community composition compared to the initial microbiome sample. Indeed, this study will be supplemented with metagenomic analysis to know the composition of the original microbiomes and of those analysed after preservation. Additionally, microbiomes from wine vinegar and fermented olive mill wastewater water are still undergoing analysis. Overall, results of this PhD project are expected to provide a greater clarification on the investigative hypothesis regarding the possibility of conserving and exploiting microbiomes from fermented beverages.

REFERENCES

1. Berg *et al.* (2020). Microbiome definition re-visited: old concepts and new challenges. *Microbiome*. 8, 103.
2. Brugnoli *et al.* (2023). Acetic acid bacteria in agro-wastes: from cheese whey and olive mill wastewater to cellulose. *Appl. Microbiol. Biotechnol.* 107, 3729-744.

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