

Innovative pulse and cereal-based food fermentations for human health and sustainable diets

Future Food Fermentation Research: Challenges, Opportunities and Priorities



**Co-funded by
the European Union**



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

The HealthFerm project

HealthFerm aims to enable an **evidence-based** transition in society and industry from traditional to **sustainable plant-based fermented** foods and diets that deliver **health benefits** to consumers **by design**

- **Citizen science** success story (> 900 fermented food samples)
- **Deeply characterized strains and consortia** with superior fermentation performance, 3 candidate novel species
- Fully annotated **Atlas of Food Microbiomes**

Microbial Resources

- **Book of Analytical Methods**
- **Nutritionally optimized fermented foods for intervention studies developed and produced at pilot scale**
- **Strains from CS project** tested in food models; leveraged for fermentation-induced changes in oat and faba bean

Consumer Behaviour

- An **ethnographic study**, generating robust knowledge
- **Two pan-EU consumer surveys** with over 14000 respondents
- Meals using **innovative plant-based fermented foods** developed and tested



Fermentation Technology

- Development + validation of **microbial biomarkers** of a **healthy microbiome and T2D risk**
- **6 intervention trials** with fermented products
- Insight into the impact of targeted **SCFA administration** on systemic availability of SCFA and on **gut hormone release**

Human Health and Microbiome

WHAT HAVE WE LEARNED?

- **Fermentation is highly context-dependent**
Not every fermentation improves every property
- **Food matrix matters**
Effects depend on substrate, process and microbial ecology
- **Health evidence is increasing**
But remains product-specific and limited for many plant-based fermented foods
- **Translation matters**
Consumer acceptance, processing, regulation and scalability determine real-world impact

FERMENTATION IS A TOOL — NOT A GUARANTEE FOR HEALTHIER FOOD

Challenges and Opportunities

Need for FAIR digital infrastructure.

Methodology and metadata are **insufficiently standardised**

A **Food Microbiome Atlas**: releasing microbiome data in a FAIR way, with well-curated metadata

Complexity of food systems. Food biochemistry and processing determine microbial activity and health benefits

Integrated approaches provides **scientific strength** in developing new, healthy foods

Food fermentation infrastructure at a pilot scale is difficult to find

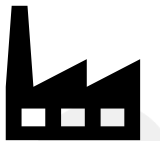
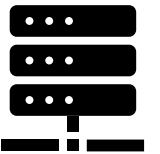
Collaboration between academia and industry: **prototype development, close to the market**

Foods are not drugs. Small effect sizes compared to pharmaceutical compounds. Need for statistical power through large and long cohorts.

Microbial markers and inter-individual response variability provides opportunities to advance **(personalized) nutrition** ((non-)responders)

Cross-disciplinary and multi-methods design of research activities **requires trade-offs**

Social sciences and consumer research towards acceptance of plant-based fermented foods and their role in the future of food



WHAT IS NEEDED NEXT?

- **RESEARCH**

- Better-designed intervention studies
- Mechanistic evidence
- Standardised characterisation of fermented foods
- Long-term and population-relevant studies

- **INDUSTRY**

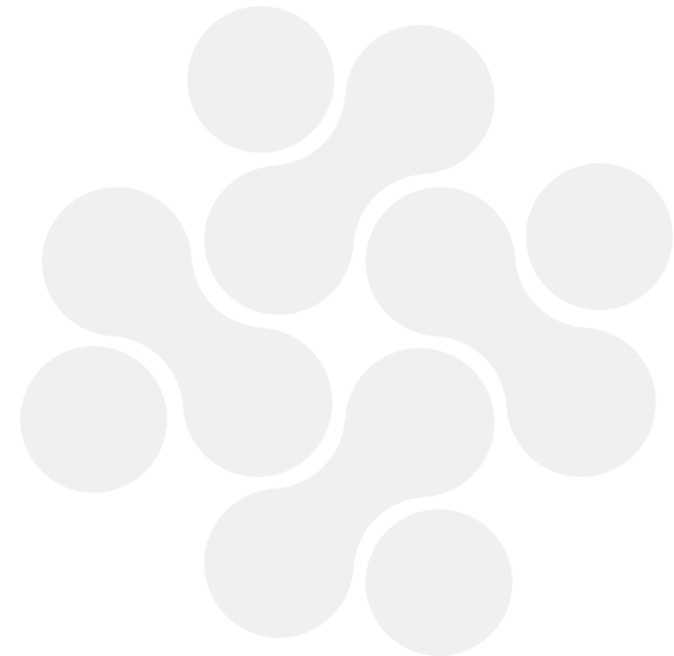
- Scale-up without losing nutritional or sensory benefits
- Transparent processing and product positioning
- Better translation of scientific evidence into products

- **POLICY & REGULATION**

- Clearer frameworks for fermented foods and health claims
- Regulation that distinguishes processing intensity from nutritional quality
- Support for evidence-based innovation

- **EU & FUNDING**

- Continued funding for interdisciplinary research by EU, but also by companies
- Shared infrastructures, datasets and microbial resources
- Better connection between food, health, microbiome and consumer research



HEALTHFERM – AN END BUT ALSO A STARTING POINT

- **KNOWLEDGE**

New data, methods and evidence for plant-based fermentation

- **RESOURCES**

Open access publications, datasets, protocols, microbial resources

- **NETWORK**

A multidisciplinary community connecting fermentation, food, health and consumers

- **QUESTIONS**

New hypotheses and research priorities that extend beyond HealthFerm