

FerFood.CH

Contribution of fermented foods to the health of Swiss consumers

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Nutrition is a major component of human health and its imbalances are associated with significant morbidity. Improving health therefore requires the promotion of foods that contribute to a healthy diet, but also have sensory qualities and sustainability that meet society's expectations. Fermented foods combine these qualities. The process of fermentation is a natural and sustainable process that has been used for thousands of years to extend the shelf life of foods. Fermentation has also been used by human civilisations to bring new sensory properties to food and, since the beginning of the 20th century, health benefits.

About a quarter of the food consumed in the world is fermented. The recognition of the importance of nutritional diversity and, more recently, of the gut microbiota on human health has encouraged new scientific work targeting, more specifically, the benefits of fermented foods. The many biochemical transformations common to the microbiological ecosystems of fermented foods and the intestinal tract are a key element of FerFood.CH's strategy to exploit the Liebefeld strain collection to introduce nutritional and microbiological diversity into fermented milks in a targeted and innovative way that is potentially beneficial to health. FerFood.CH goes beyond the 'fermented milk' model and has a vision to integrate fermented foods into the Swiss food pyramid through interventional and observational human studies.

Objectives

The vision of FerFood.CH is that **fermented foods** are specifically integrated into the **Swiss food pyramid**. In order to realise this vision, four sub-projects focusing on the quality of fermented foods in a translational approach will be conducted with the following goals:

- Subproject 1: Production of fermented milks with **bacteria** from the **Liebefeld collection** maximising the production of metabolites with proven health benefits and characterizing these products in animal and *in vitro* models.
- Subproject 2: Verification and **functional characterisation** of the nutritional quality of the fermented milks of subprojects 1 and 3 by investigations in **human interventional studies**.
- Subproject 3: Identification and **validation** in a **human cohort** of associations between the consumption of different fermented foods and **metabolic health**, investigating how individual specificities influence these relationships.
- Subproject 4: **Synthesis** of knowledge on the role of fermented foods on human health using the scientific literature and the results of the work carried out during the project, in order to communicate them to the different stakeholders, the general public and the competent authorities.

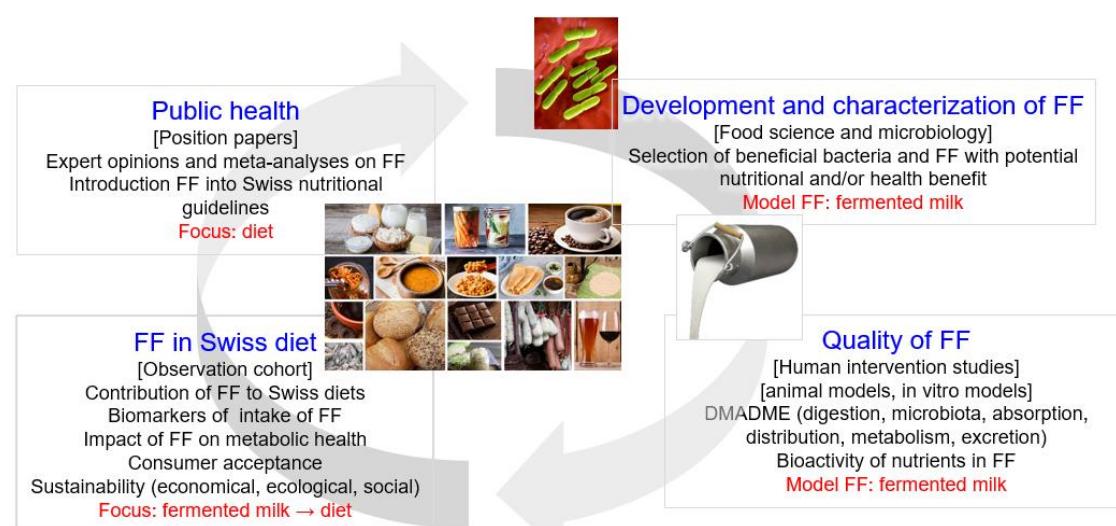


Figure. Overview of FerFood.CH project at Agroscope

Impact

- The long-term health of the **Swiss population** will be improved through more conscious consumption of fermented foods.
- **Consumers** will gain a better understanding of fermented products and realise that it is healthy, safe and tasty to "eat bacteria" and even prepare these products themselves.
- **Citizens** will be able to influence research by being invited to participate in the establishment and development of the FerFood.CH project.
- As fermentation is a gentle process, **producers** can better promote the quality of their primary production.
- As the fermentation process is not complex, **SMEs** producing new niche fermented products could be created.
- Fermentation can reduce losses of fresh products, thus contributing to an improvement of the **environmental impact** of the food chain.

Subproject 1: Development of fermented products with targeted nutritional properties

Sub-project leader Cornelia Bär; deputy Barbara Walther

The aim of this sub-project is to produce fermented foods with specific nutritional properties. This is achieved by establishing **genotype-phenotype** relationships based on the annotated genome of the **~1'000 bacterial strains** in the Liebefeld collection as well as on the fermentation-induced changes in the molecular composition of milk. Fermented milk is used as a model, as its production process allows a rapid screening of numerous bacterial strains. The selection of fermented milks is based on a targeted strategy to maximise the production of metabolites with a **proven positive effect on health**. Some of these metabolites (vitamins B9 and K, indoles, phenyllactic acid) have immunomodulatory and metabolic properties that make them particularly interesting in the current pandemic context. In parallel, a **non-targeted strategy** uses **metabolomics** to analyse several thousand molecules in milk and determine those with health potential. The methodology can be adapted to the fermentation of other food matrices, e.g. of plant origin. **Animal** (mice...) and **in vitro** (digestion, metabolism by human microbiota...) **models** are used to evaluate the **bioavailability** and **bioactivity** of the active ingredients produced in the selected foods.

Subproject 2: Functional characterisation of the nutritional quality of fermented foods

Sub-project leader Guy Vergères; Deputy: Ueli Bütkofer

In partnership (e.g. NutriExhalomics project, ETHZ), this subproject documents the health properties of foods (especially fermented milks) from other projects (subprojects 1 and 3...) in **functional models**. **Human interventional studies** establish, in a targeted manner, the **bioavailability** and **bioactivity** of the active ingredients produced in the selected foods. Non-targeted approaches of **metabolomics** (blood, urine, saliva, faeces) and **metagenomics** (intestinal microbiota) allow the identification of markers of the consumption of these foods as well as their effects on health. Finally, the concept of **precision nutrition** is integrated into FerFood.CH to define the impact of the fermentation of specific foods, such as A1 and A2 milks derived from genetic variants of beta-casein, on the metabolic response of groups of consumers (lactose-intolerant, etc.). The methodology can be adapted to the analysis of other food groups.

Subproject 3: Nutritional and environmental impact of fermented products in the diet of an observational cohort

Sub-project leader Kathryn Pimentel; Alternate: Guy Vergères

Using data from **observational cohorts** (carried out in partnership, e.g. UNIL) we first develop a **new classification** of nutritional data allowing to highlight subgroups of fermented foods. This classification, combined with the use of biomarkers of fermented products (cf. sub-project 2) measured in biological samples by metabolomics, allows a better **quantification** of the **consumption of fermented products** in future nutritional studies and Swiss cohorts. We then investigate in a cohort the links between consumption of different fermented products, **metabolic health** (clinical markers) and individual information (**genomic** and **phenotypic**). The nutritional properties of the foods will be confirmed through

new studies (sub-project 2). We will also assess what role fermented foods could play in a **sustainable food** context (environmental, economic, social).

Subproject 4: Introduction of fermented foods into Swiss nutritional recommendations

Sub-project leader Barbara Walther; Deputy: Kathryn Pimentel

The vision of FerFood.CH is that the health effects of fermented products should be specifically **recommended** to the **Swiss population**, in other words that the bacteria and fermentation products in fermented foods should be recognised as an important component of a **healthy diet**. The sub-project will integrate a **living lab** approach and the **citizen** in the development process of FerFood.CH. It will also conduct a synthesis of the results of the work during the project period (sub-projects 1-3), integrated with recent scientific knowledge (e.g. COST PIMENTO action), to **communicate** them to the various stakeholders. This synthesis work will aim to highlight the **quality of fermented foods** (nutrition/health, sustainability, consumer perception) in a 'One Planet - One Health' framework. A final report from FerFood.CH will be submitted to the competent authorities presenting the elements supporting the integration of fermented products in the **Swiss food pyramid**. The methodology could be adapted to the analysis of other food groups.

Key contribution to national and international activities (Guy Vergères)

Chair [NuGO](#), the International Nutrigenomics Organization

Leader WP3 Cost Action CA20128 - Promoting Innovation of ferMENTed fOods ([PIMENTO](#))

Chair Task Force Swiss Research Network – Healthy Nutrition ([SRN-HN](#))

Principal Investigator [NutriExhalomics](#), Zurich-Exhalomics