

# The sensory and microbial diversity of Bernese Alp Cheese

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## Introduction & Aims

Bernese Alp Cheese (*Berner Alpk ese AOP*) is produced on more than 500 alps in the mountain regions of the Canton of Berne. It is produced in a traditional way under simple production conditions. E.g., wood firing must be used to heat the milk.

Acidification of the milk takes place using a natural whey culture (NWC) which is started at the beginning of the alp season with a dedicated lyophilised culture supplied by the Liebefeld Kulturen AG. We followed NWCs on three alps during the entire season and took a variety of samples on 16 alps on one production day to:

- Assess the stability of the NWC
- Understand the diversity of Bernese Alp Cheese and the reasons for it
- Create a knowledge base for knowledge transfer

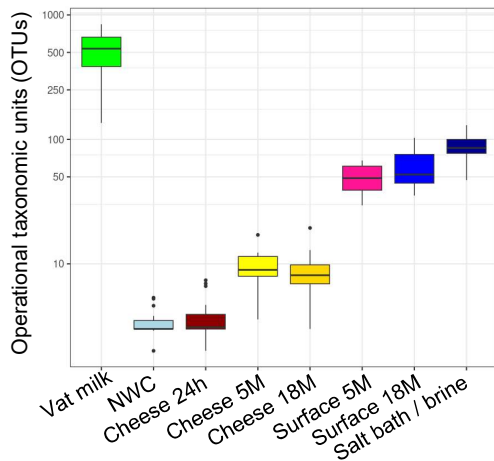


Fig. 1: Bacterial diversity in different samples along cheese production. NWC, natural whey culture.

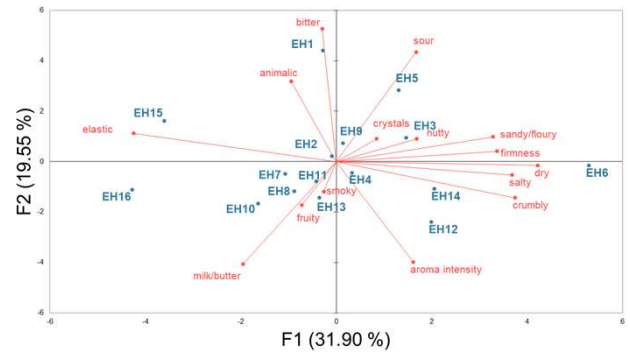


Fig. 2: Sensory analysis (here, after 18 months of ripening) showing the diversity of Bernese Alp Cheese. EH: individual cheese wheels from different alps

## Methods & Results

For 16 alps, we sampled vat milk, NWC, salt bath and cheese after 24h, 5 months and 18 months of ripening. For 3 alps, we took NWC samples daily. Additionally, we collected a wide range of metadata on alp, production and ripening parameters.

Microbial diversity was assessed by 16S amplicon sequencing (Fig. 1). Surprisingly, species diversity was very low in the cheese dough and primarily consisted of *Streptococcus thermophilus* and *Lactobacillus delbrueckii*. No *L. helveticus* was found in any of the samples. Illumina sequencing of the approx. 200 NWC samples has demonstrated the presence of functionally redundant strains for each species. Also, phage dynamics could be assessed and have shown an arms race between the resilient NWCs and the invasive phages (not shown).

Despite its microbiological **uniformity simplicity**, there is a substantial **well perceptible** terroir effect, as seen by sensory analytics (Fig. 2).

## Acknowledgements

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## Summary

- Bernese Alp Cheese is a very diverse product, however the bacterial diversity of its dough is surprisingly low
- The natural whey culture used in its production is very resilient to phages and stable during an entire alp season
- Lessons learnt from these samples allow us to understand bacterial dynamics in more complex ecosystems