Microbial communities of homemade fermented vegetables

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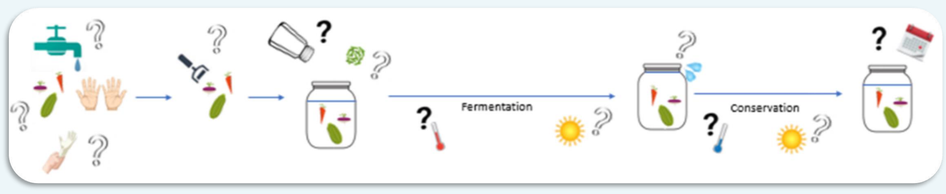
CONTEXT & AIM

- ✓ Fermentation : an ancestral process of preserving food that has recently received a renewed interest because of its natural image, nutritional interest, and potential for innovation.
- ✓ Excepted sauerkraut, fermented foods issued from vegetables have been little consumed in Western Europe, in contrast with central Europe and Asia.
- ✓ FLEGME "Fermentation des LEGuMEs": a citizen science project that gathers citizens, SMEs, agricultural schools, culinary journalists, researchers, ….
- ✓ One of its goal is to characterize the microbial communities and the safety of home-made fermented vegetables and isolate strains.

STRATEGY

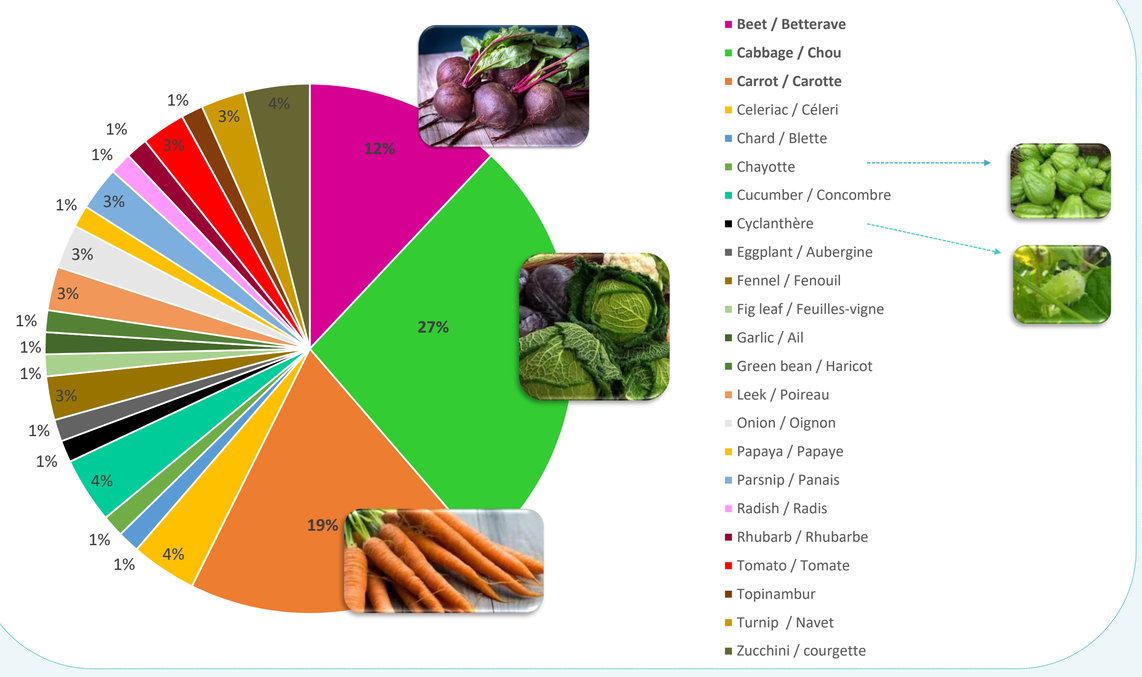
- ✓ Constitution of a community of > 250 citizens that manufacture fermented legumes for their personal consumption
- ✓ Home-made fermented vegetables collected from Feb, to Oct 2020, as well as the manufacturing conditions, practices, and recipes via an online survey



- ✓ Desirable/undesirable microbial groups assessed by a culture-dependent approach:
  - lactic acid bacteria (LAB)
  - total aerobic bacteria,
  - *Enterococcus*, *Enterobacteriaceae*,
  - spore-forming bacteria,
  - pathogenic bacteria

RESULTS

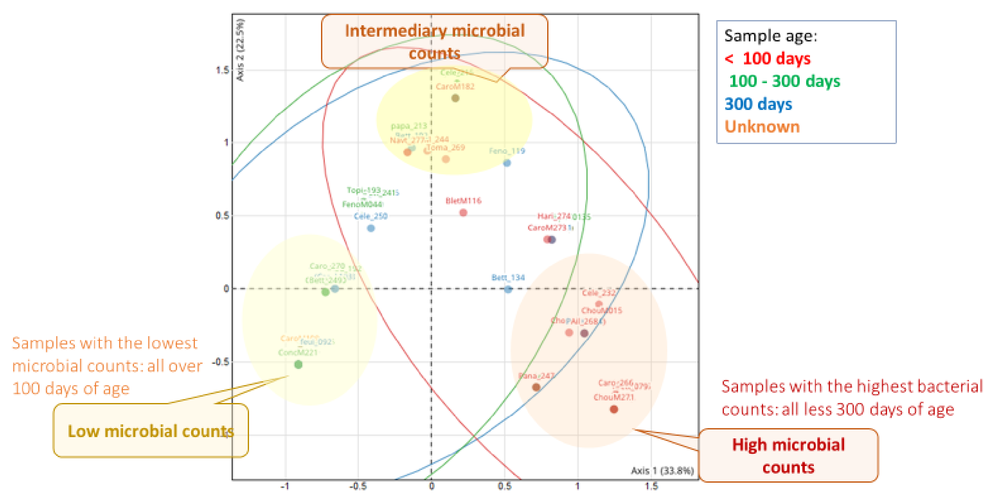
A large diversity of fermented vegetables collected from citizens (n=75) and various manufacturing practices and recipes



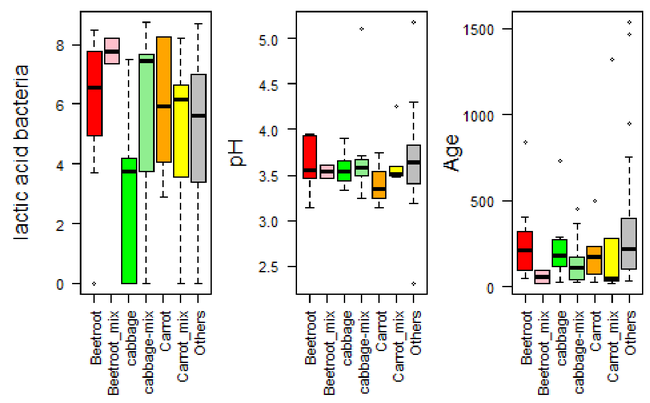
- ✓ 23 types of legumes, the most represented being cabbage (27%, 7 varieties), carrots (19%) and beets (12%), most of them coming from from organic commercial production or garden vegetables
- ✓ Various manufacturing practices: vegetables peeled or not, various washing practices and slicing preparations (in pieces, sliced, minced, grated)
- ✓ Recipes include in general 1 to 2 spices and/or seasonings (garlic, coriander seeds, pepper, thyme, cumin, gingers, bay leaf being the most used)
- ✓ Spontaneous fermentation for 71 out of 75 samples (for the 4 others, 3 using backslopping and 1 kefir for inoculation)

Relationship between the age of samples and their viable microbial counts

Multiple correspondence analysis (MCA)



Several microbial groups, low pH and no pathogenic bacteria



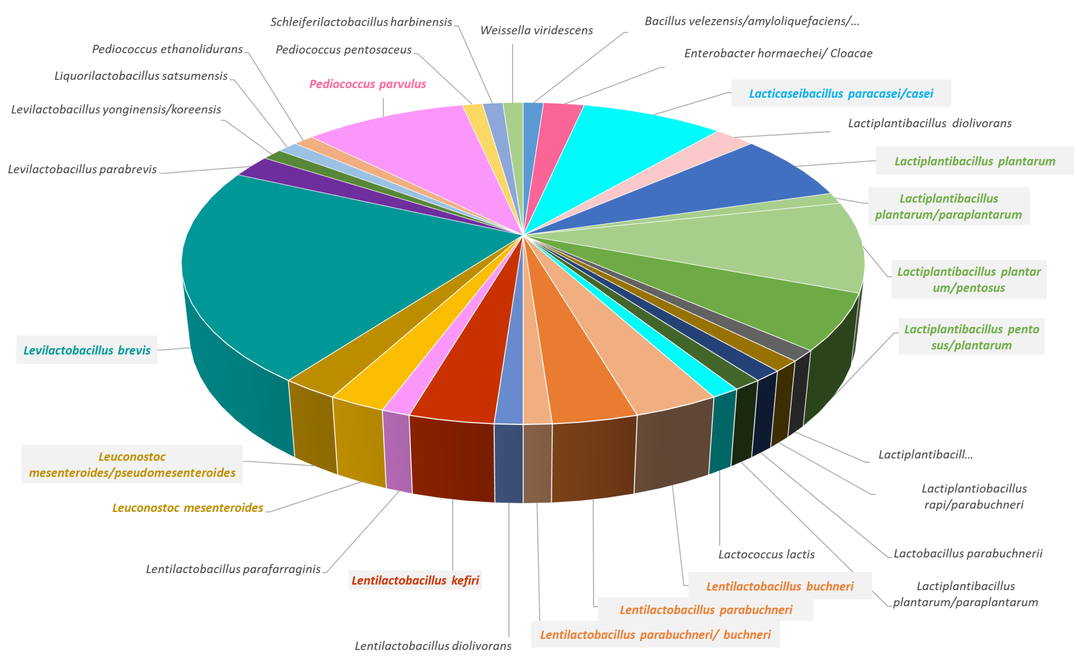
LAB counts: median : 7.5x10^4 CFU/g
- from non-detectable to 6x10^8 CFU/g

pH: median pH: 3.6
- 87% of samples between 3.2 and 4.0
- pH>4.5 for only 2 samples

Storage period (sample age):
- median 6 months
- from 2 weeks to 4 years

- ✓ LAB represented the dominant population
- ✓ No pathogenic bacteria detected (*Escherichia coli, Clostridium perfringens*, coagulase positive staphylococci, *Salmonella*, *Listeria monocytogenes*)
- ✓ Enterococci detected in only 5 samples, at counts < 10^5 CFU/g
- ✓ Yeasts detected in almost half of the samples, at counts ranging from 10^2 to 9x10^7 CFU/g

90 isolates of lactic acid bacteria – 30 species



- ✓ 1 – 3 isolates randomly picked up on culture media dedicated to LAB numeration conducting to the collection of 90 LAB isolates
- ✓ Clones were identified by 16S sequencing: 31 taxons identified
- ✓ *Levilactobacillus brevis* and *Lactiplantibacillus plantarum/paraplantarum* group were the most common, with 21 and 20 % of total number of isolates

CONCLUSION

- ✓ No significant relationship between the pH, LAB counts and the type of vegetables was observed.
- ✓ However, a significant effect of the age of samples was observed: high LAB counts were most frequent observed in the youngest samples (age < 100 days).
- ✓ This first view of the microbial community of fermented vegetables based on culture-dependent analysis will be completed by 16S rRNA gene metabarcoding
- ✓ Constitution of collection of lactic acid bacteria representative of the LAB diversity of fermented vegetables (90 strains, 30 species) available for research community

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