ASSESSMENT OF MICROBIOLOGICAL SAFETY AND QUALITY OF PLANT-BASED ALTERNATIVE PRODUCTS

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ACTUALITY OF THE TOPIC

- The shift from animal-based proteins to plant-based alternatives has significantly increased in recent years, largely driven by a combination of environmental, health, and animal welfare concerns of consumers.
- The market of plant-based alternatives is rapidly expanding and evolving, it is expected to reach around 46 billion euros by 2027.
- New technologies and processing methods mostly used for the production of alternative products may pose new food safety risks including microbiological hazards.

AIM OF THE STUDY

- This study aimed to assess the **microbiological safety** and **quality** of plant-based alternatives from Estonian retail level within 10-months period during 2024-2025.

MATERIALS AND METHODS

- Meat, dairy and seafood alternative products were collected.
- Sampling was done on a monthly basis and each month ~15 samples were analysed.
- In total 147 samples were analysed.
- All samples were analysed in duplicate.

The following analyses were done:

- Aerobic colony count at 30 °C (ISO 4833-2);
- Yeasts and molds (ISO 21527-1);
- *Escherichia coli* (ISO 16649-2);
- *Clostridium* spp. (ISO 15213-1);
- *Bacillus cereus* (ISO 7932);
- *Listeria monocytogenes* (ISO 11290-1;2).

RESULTS

L. MONOCYTOGENES AND *E. COLI*

- Within the study period *L. monocytogenes*, *Listeria* spp. and *E. coli* were not detected.
- This can be explained with ultra-processing technologies often used for alternative products.
- The use of high pressures and high temperatures in the production may have bactericidal effect.

SPORE-FORMING BACTERIA

Spore-forming bacteria are particularly resistant.

The primary spore-forming microorganisms of concern are *Clostridium* and *Bacillus* species.

- *Bacillus* spp. was found in 14.3% (n=21) of products.
- *Clostridium* spp. was detected in 22.5% (n=33) of products.

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Species	Occurence	Average concentration
***Clostridium* spp.**	22.4%	$4.5x10^1$ cfu/g
***Bacillus* spp.**	14.3%	$3.2x10^1$ cfu/g
Yeasts and molds	NA	$2.2x10^3$ cfu/g
Mesophilic aerobic microorganisms	NA	$8.8x10^3$ cfu/g

NA, not applicable

Table 1. Results of microbiological analyses of 147 alternative products at Estonian retail

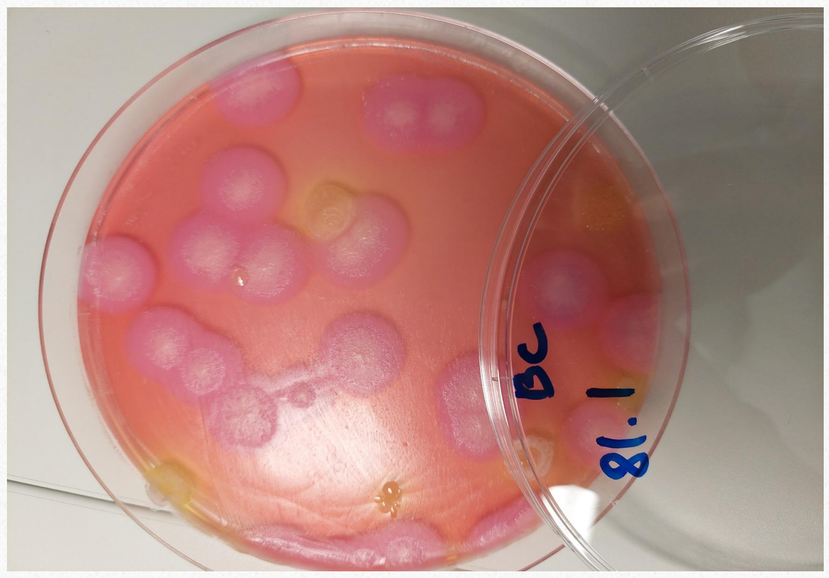

Figure 1. *Bacillus* spp. from plant-based meat alternative product.
Photo by K. Meremäe.

CONCLUSIONS

- Preliminary results show that alternative products at retail level are of **high microbiological quality and safety**.
- Although in low concentrations, plant-based analogues contain some **pathogenic bacteria** or spores.
- MALDI-TOF MS resulted with identification of some **opportunistic pathogenic microorganisms** not usually associated with food microbiological safety.

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LABRIS National Centre for Laboratory Research and Risk Assessment

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