Federal Department of Home Affairs FDHA
Federal Food Safety and Veterinary Office FSVO
Research Management

Section **Fields (of activity)**

Survey of the prevalence of pathogens and spread of their antibiotic resistance in Swiss raw meat products

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Key words
pathogens, Switzerland, raw meat products, raw cured products, raw sausages, antibiotic resistance, hepatitis E virus, canton Grisons

Aim of the study
Main objective
Main objective of the project was to identify food safety issues for raw meat products in Switzerland.

Interim objectives
To achieve the main objective, the first intermediate objective was to generate data on the distribution of pathogens in these products. These data have been obtained by collecting and analysing samples from all over Switzerland. During 2 years, raw meat products were analysed for pathogenic and antibiotic resistant germs (*E. coli*, *Enterobacteriaceae*, *Listeria*, *Salmonella*, *Staph. aureus*, STEC, *Yersinia enterocolitica*) and hepatitis E viruses. Samples were taken from small butchers (artisanal production), medium and large industrial enterprises. Strains from positive samples were isolated and will be further identified.
When data were available they were analysed in the second intermediate objective, e.g. statistically or with graphical representation of the data. This evaluation made it possible to identify regional risks, product or seasonal risks.
With the publication of the data and the proposals for further measures, the main objective of the project will be achieved.

Long-term goals
The newly acquired information and the strain collection (wild isolates) are also available to achieve long-term goals. These include the definition and implementation of follow-up projects, for the safe production of raw meat products or the implementation of challenge tests for which the use of food-derived pathogen strains (wild strains) is mandatory. The long-term goals contribute to ensuring the food safety of raw meat products and are also intended to cover the concerns of small artisanal and medium-sized butchers.

Material and methods
Samples of approximately 800 raw meat products (e.g. Bündnerfleisch, Landjäger, raw bacon, raw ham, salami, Ticino dried meat, Valais dried meat) were collected throughout Switzerland. The sample were collected during two years, from October 2017 to April 2019.
Sampling was organised in two ways. Of the approx. 800 samples, approx. 600 came from small artisanal butchers (artisanal businesses). The organisation of this sample, i.e. the recruitment and continuous information of the butchers, was organised by ABZ Spiez. The samples were sent by the butchers to Agroscope (express in cool boxes) and analysed. The remaining approx. 200 samples from medium-sized and large butcheries are procured by Agroscope staff at the point of sale and also analysed at Agroscope. In order to be able to make a statistical

distinction between regions, products and seasons, the sample was organised in such a way as to ensure the best possible distribution of factors. For this reason, data such as sample point and product name were also recorded. These data were treated confidentially.
If a sample exceeded the official limits, Agroscope (for the samples collected at the point of sale) or ABZ Spiez (for the small butcheries samples) contacted the producer directly.

The following analyses were carried out for each sample; the method used is given in brackets:
- Antibiotic resistance (enrichment with double peptone water, selective growth for ESBL (oxoid), CRE (oxoid), VRE (oxoid), ECC (were, Paris), further characterisation by API tests).
- *E. coli* (BioMérieux TEMPO-EC)
- *Enterobacteriacea* (BioMérieux TEMPO-EB)
- *Listeria* and *Listeria monocytogenes* (ISO 11290-2:1998/Amd.1:2004)
- *Salmonella* (ISO 6579:2002)
- *Staphylococcus aureus* (BioMérieux TEMPO-STAPH)
- STEC (ISO TS 13136, modified)
- *Yersinia enterocolitica* (PCR Method)

In addition to the above methods, approximately 200 samples were analysed for the presence of HEV genomic material by the FSVO laboratory using real-time reverse transcriptase PCR. Of these approx. 200 samples, approx. 100 came from so-called high-risk raw meat products such as "Mortadella Cruda" and "Leber Salsiz" with raw liver. The other approx. 100 samples were low-risk samples, i.e. raw sausages without raw liver. These analyses were carried out in close collaboration with R. Felleisen and D. Moor (both FSVO).

The data generated were statistically analysed to calculate the prevalence of foodborne pathogens in raw meat products in Switzerland and to identify any differences between regions, seasons and individual products.

Results and significance
From October 2017 to April 2019, the prevalence of pathogenic microorganisms in Swiss raw meat products (raw cured meats and raw sausages) was determined. The samples were collected twice a year, in spring and autumn. All samples were negative for *Salmonella* spp. and *Yersinia* spp. Among the Listeria, 2.5 % were positive for *L. monocytogenes* and 1 % for other *Listeria*. *Staph. aureus*, *Enterobacteriaceae* and *E. coli* were detected in all samples, but mostly at low concentrations. Regarding STEC, 2.4 % of the samples were positive. Raw sausage products showed a higher contamination than raw cured products, especially for STEC. The samples from autumn were more affected by *L. monocytogenes*, *Staph. aureus*, *Enterobacteriaceae* and *E. coli* than those from spring; for STEC, the season did not play a major role. Enterprise size only played a role for *L. monocytogenes*, with a 3-fold increased incidence in large enterprises. For *Staph. aureus* and *Enterobacteriaceae*, the proportions of samples with > 100 cfu/g were very close to each other, for *E. coli* the proportions were identical. In the case of STEC, it is noticeable that small butcheries from the Alpine region were more frequently positive. In addition, as with *L. monocytogenes*, there were enterprises that were positive several times.
For *L. monocytogenes* and STEC, there is a need for action, especially for raw sausage. Raw cured meat and raw sausage should in principle be free of *L. monocytogenes* and STEC, which is why further efforts are needed here.
The value for vancomycin-resistant enterococci was quite low at 1.5 %, while a prevalence of 1.24 % was found for ESBL *Enterobacteriaceae*. Remarkably, 9 of these ESBL positive germs were also Colistin resistant, an antibiotic used as a last resort. Carbapenemase producing *Enterobacteriaceae* were not detectable and MRSA was only detectable in 0.57 % of the *Staph. aureus* positive samples.
In a sub-project, the occurrence of hepatitis E viruses in the canton of Grisons was investigated. For products with pork liver, the prevalence was 6.7 %, for products with wild boar meat a value of 12.5 % was found and the lowest value was 1.1 % for products with deer meat.

Publications, posters and presentations
- Survey of the prevalence of pathogenic organisms in Swiss raw meat products (provisional title), Lead T. Berger, in progress.
- Occurrence of pathogenic organisms in Swiss raw meat products - is there a need for action? (provisional title, practical paper), Lead H. Stoffers, planned

- Prevalence of hepatitis E virus in raw meat products from the canton of Grisons (provisional title), Lead L. Schwendimann, planned
- Spread of antibiotic resistance in pathogens from Swiss raw meat products (provisional title), Lead E. Marti Serrano, planned/start in April

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