Safety challenges associated with traditional foods

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F.-K. Lücke, TRAFOON Conference, Olsztyn, 13 Sept 2016
Topics

1. Introduction
2. Safety of traditional meat products
   (with focus on fermented sausages)
3. Safety of traditional cheeses
4. Safety of traditional fish products
5. Botulism and traditional foods
6. Risks from modifications of traditional techniques
7. Food safety management in Small and Medium-sized businesses (SME) producing traditional food
8. Conclusions
Why interest in traditional foods?

- Consumers wish to buy “local / regional”
- Retailers seek to maintain an individual profile in competition with discounters
- Globalisation, business travel, tourism → Consumers are interested in foods traditional in other regions
Regulation (EU) No. 1151/2012:

„‘traditional’ means proven usage on the domestic market for a period that allows transmission between generations; this period is to be at least 30 years”.

→ Not limited to foods included in the DOOR List (PDO, PGI, TSG)
Some examples of traditional foods in Central Germany (Südniedersachsen, Nordhessen, Nordwestthüringen)

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Product</th>
<th>Protected acc. to Reg. (EU) 1151/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Rye-wheat bread („Graubrot“)</td>
<td>No</td>
</tr>
</tbody>
</table>
| Milk         | • Dickmilch  
   • „Harzer“ (surface-ripened acid curd cheese)  
   • Quark | • No  
   • Hessischer Handkäse PGI; Nieheimer Käse PGI  
   • No |
| Meat         | • “Air-dried” fermented sausage  
   • Slightly fermented sausage  
   • “Kochwurst” (with rinds, blood or liver; often canned) | • Eichsfelder Mettwurst PGI  
   • No  
   • Thüringer Leberwurst, Thüringer Rotwurst PGI |
| Vegetables   | Sauerkraut | No |
| Fruit        | • „Rote Grütze“ (from local berries)  
   • „Kompott“ (fruit pieces in wecks) | • No  
   • No |
Cheeses with surface smear

Kleinste Helfer bei der KÄSE herstellung

Untersuchungen zur Vielfalt der Rotschmiere-Flora
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Ripening room for „air-dried“ fermented sausages

What about wood and loam?

Is the mould safe?

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Air-dried fermented sausage

Nordhessische Ahle Wurscht

Foto: D. Eirdosh

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Kochwurst

aid, Bonn: Fleisch und Fleischerzeugnisse

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Notified „unsafe“ traditional (processed) food in Europe January – August 2016 (from RASFF portal) - not necessarily involved in outbreaks (!)

<table>
<thead>
<tr>
<th>Food</th>
<th>Country of origin</th>
<th>Microbial agent</th>
<th>Number of notifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw milk (soft, semi-soft) cheese</td>
<td>France</td>
<td><em>Listeria monocytogenes</em></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>Shigatoxin-forming <em>E. coli</em></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td><em>Salmonella</em></td>
<td>1</td>
</tr>
<tr>
<td>Other cheeses*</td>
<td>various</td>
<td><em>Listeria monocytogenes</em></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>various</td>
<td>Shigatoxin-forming <em>E. coli</em></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>various</td>
<td><em>Salmonella</em></td>
<td>1</td>
</tr>
<tr>
<td>Fermented meats</td>
<td>various</td>
<td><em>Listeria monocytogenes</em>**</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>various</td>
<td><em>Salmonella</em></td>
<td>3</td>
</tr>
<tr>
<td>Cooked meats</td>
<td>various</td>
<td><em>Listeria monocytogenes</em></td>
<td>2</td>
</tr>
<tr>
<td>Smoked fish</td>
<td>various</td>
<td><em>Listeria monocytogenes</em></td>
<td>11</td>
</tr>
</tbody>
</table>

*loafs mostly treated (smeared, grated, inoculated) after lactic fermentation; soft or semi-soft

**not involved in outbreaks of listeriosis

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Traditional fermented sausages (I)

<table>
<thead>
<tr>
<th>Microbial hazard to be controlled</th>
<th>Outbreaks</th>
<th>Preventative measures: Choice of high-quality raw material* and …</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella</em></td>
<td>Yes, verified</td>
<td>Correct combination of “hurdles” (initial pH, salt, nitrite, rate and extent of acid formation, temperature) early in fermentation</td>
</tr>
<tr>
<td>Shigatoxin-forming <em>E. coli</em></td>
<td>Epidemiological evidence</td>
<td></td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>None reported</td>
<td></td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>None reported</td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus aureus enterotoxin</em></td>
<td>Yes, verified</td>
<td>Rapid acid formation; fermentation temperature below 25 °C, ageing temperature below 15 °C</td>
</tr>
<tr>
<td>Histamine</td>
<td>None reported</td>
<td>Use of appropriate starter cultures</td>
</tr>
</tbody>
</table>

*pH below 5.8; obtained from hygienic slaughtering with minimal contamination by faecal material and infected wounds (*S. aureus*); natural casings carefully cleaned*
**Traditional fermented sausages (II): Pathogen reduction during sausage fermentation** (from Lücke & Zangerl 2014)

<table>
<thead>
<tr>
<th>Product</th>
<th>Total ripening time (days)</th>
<th>Pathogen</th>
<th>Approx. decimal reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-dry</td>
<td>21-23</td>
<td><em>Salmonella</em></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>STEC</em></td>
<td>2</td>
</tr>
<tr>
<td>Spreadable</td>
<td>&lt;14</td>
<td><em>Salmonella</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>STEC</em></td>
<td>&lt;1</td>
</tr>
<tr>
<td>Product</td>
<td>Agent</td>
<td>What went wrong</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------------------------------------</td>
<td>------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Fresh raw (pork) sausages</td>
<td><em>Salmonella</em></td>
<td>Insufficient acid formation (no lactic starter, low sugar)</td>
<td></td>
</tr>
<tr>
<td>Ripened (dried) sausages</td>
<td><em>Salmonella</em></td>
<td>Use of nitrate, no lactic starter, low sugar (→ slow/delayed acid formation), combined with high ripening temperature</td>
<td></td>
</tr>
<tr>
<td>Sausages containing meat from ruminants</td>
<td>Shigatoxin-forming <em>E. coli</em></td>
<td>Poor control of slaughtering process (ruminants)</td>
<td></td>
</tr>
<tr>
<td>Mould-ripened and/or “air-dried” sausages</td>
<td><em>Staphylococcus aureus</em> enterotoxin</td>
<td>Slow acid formation, too high temperatures during and after the lactic fermentation → excessive surface growth</td>
<td></td>
</tr>
</tbody>
</table>

**Underlying cause:** Inappropriate modification of traditional methods in order to accelerate ripening, cut production costs and scale-up production
Traditional fermented sausages (IV): Rules for safe production

- Select a meat supplier with good control on the slaughtering process
- Only use meat of low pH (<6.0, preferably ≤5.8)
- At fermentation temperatures above 18°C,
- always use lactic acid bacteria as starters and
- use nitrite rather than nitrate as curing agent. If you do use nitrate, combine it with nitrate-reducing starter cultures.

**NB:** There is now a wide choice of starter cultures available adapted to various traditional sausage formulations.
## Traditional cheeses (I): Risk factors – what went wrong?

<table>
<thead>
<tr>
<th>Product</th>
<th>Microbial agent</th>
<th>What went wrong?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft / semi-soft cheeses with surface smear or internal mould growth</td>
<td><em>Listeria monocytogenes</em></td>
<td>Recontamination during cheesemaking</td>
</tr>
<tr>
<td>Soft / semi-soft cheese* made from raw milk</td>
<td><em>Shigatoxin-forming E. coli (STEC); Salmonella</em></td>
<td>Contamination of raw milk by ruminant faeces; slow / delayed acid formation</td>
</tr>
<tr>
<td></td>
<td><em>Staphylococcus aureus enterotoxin</em></td>
<td>Use of milk from cows with mastitis; contamination of raw milk; slow / delayed acid formation</td>
</tr>
</tbody>
</table>

*aged for less than 60 days
Cheeses with surface smear

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Traditional cheeses (II)

Problem:

● Use of raw milk because
  1. there is no need for expensive equipment to pasteurise milk without denaturation of whey proteins
  2. dairies usually do not accept goat’s and ewe’s milk for processing
  3. some consumers prefer cheeses from raw milk for sensory reasons

Solution (especially to SME):

● Have strict control of raw milk quality
● Age raw milk cheese for at least 60 days;
● Consider buying equipment for long-time low-temperature pasteurisation to make other products
Traditional cheeses (III)

Problem:
● Activity of „in-house“ starter under poor control

Solution:
● Use DVA starters and/or test for activity

Problem:
● Contamination after pressing and lactic fermentation (smearing, punching etc.) by e.g.
  1. Re-use of „old smears“ for surface inoculation
  2. Punching (blue-veined cheese)
  3. Grating of final product

Solution:
● Separate processes (e.g. by handling of cheese outside the farm)
● Optimise cleaning and disinfection
Main (microbial) food safety problem:
- Contamination by *Listeria monocytogenes* during production of smoked and or „gravad“ fish products with extended (refrigerated) shelf life

Also to be considered:
- Contamination by *Clostridium botulinum* (non-proteolytic strains); in particular
  - in poorly managed (pond) aquaculture
  - in parts of the Baltic Sea

Both bacterial species have growth potential on various smoked fish at 7°C.
Human botulism in Europe is caused by improper preservation of certain foods at home
Epidemiology of botulism – Poland as example

Botulismus-Fälle in Polen
(GALAZKA & PRZYBYLSKA, Eurosurveillance 4, 69, 1999)

- Less home canning
- Availability of autoclaves even in small processing units
## Foods involved in cases of botulism

<table>
<thead>
<tr>
<th>Product</th>
<th>What went wrong?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw hams, not injection-cured</strong></td>
<td>Salting / Curing</td>
</tr>
<tr>
<td></td>
<td>• of meat with high pH</td>
</tr>
<tr>
<td></td>
<td>• at too high temperatures</td>
</tr>
<tr>
<td></td>
<td>• too short</td>
</tr>
<tr>
<td><strong>Canned sausages containing liver or blood</strong></td>
<td>• Insufficient heating <em>and</em> insufficient refrigeration during storage</td>
</tr>
<tr>
<td><strong>Other canned low-acid food (vegetables)</strong></td>
<td>• Insufficient heating <em>and</em> insufficient refrigeration during storage</td>
</tr>
<tr>
<td></td>
<td>• Insufficient acidification</td>
</tr>
<tr>
<td><strong>Marinated fish</strong></td>
<td>• High spore load</td>
</tr>
<tr>
<td></td>
<td>• Insufficient levels of acid (vinegar) and/or salt</td>
</tr>
<tr>
<td></td>
<td>• Insufficient refrigeration</td>
</tr>
</tbody>
</table>

The effect of nitrite on consumer risk is often overestimated.
Possible risks from modifications of traditional techniques to manufacture traditional foods

- MAP and other attempts to extend shelf life → listeriosis
- Upscaling, installation of equipment with poor „hygienic design“ → listeriosis
- Reduction of salt, sugar, acid, fat without „compensation“ by other „hurdles“
- „Newcomers“ collect poor formulations and process instructions from unreliable sources in the Internet; „hype“ about „naturally fermented vegetables“
- Vegetable preparations in plant oil → botulism
Food safety management in small and medium-sized businesses (SME) producing traditional food
Small and medium sized enterprises ...

- are an essential part of the food sector and of the social and occupational infrastructure in rural and urban areas
- maintain a large diversity of high-quality food, especially traditional food
- can react in a flexible way to the demands of the consumer

... but face constraints in setting up food safety management systems
SME: Constraints in Comparison to Large-scale Enterprises
(Modified from Lücke & Janssen 2002)

- Missing specialists → responsible employees often face work overload and „multi-tasking“;
- Adherence to traditional (non-delegating) management;
- Missing information about existing know-how outside the organisation (→ key role of trade/industry associations and professional bodies)
- Higher production costs per unit;
- Less financial resources for investments;
- Less influence on economic system, society and politics;
- Less possibility for in-house verification of process safety because of lack of own laboratory or little laboratory equipment;
- Weak position in negotiations with suppliers and customers (and official food inspection)

→ SME‘s often complain about ever increasing (costly) requirements, bureaucracy and paperwork
Frequent deficiencies in HACCP implementation in SME (Trafiałek et al. 2015)

- Too many flow charts with too little information needed for hazard analysis
- Hazards not specified to an extent required to define control measures
- Too many CCP identified
- Sampling and (laboratory) testing methods used for monitoring at CCPs
- Inconsistent use of the term „CP“
- Mix-up between „Good Hygienic Practice“ and HACCP, and between „corrections“ and „corrective actions“
- No „slim“ documentation of plans and records
Ripening room for „air-dried“ fermented sausages

What about wood and loam?

Is the mould safe?

EC 852/2004, “Whereas” No. 16: Flexibility to enable continued use of traditional methods

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Annex II states

- the crucial role of general food hygiene („prerequisite requirements“)
- the crucial role of notified Codes of Good Hygienic Practice, in particular for caterers, restaurants, pâtisserie, and butcher’s shops
- that in certain businesses, there is no general need for setting up a complete HACCP system
- that documents and records „should be well-balanced and can be limited to what is essential with regard to food safety“, and gives instructions how to prepare these.
Conclusions (I)

- The main risk factors in the production of traditional fermented meats and (soft and semi-soft) raw milk cheeses include:
  - poor control on the quality of the raw material
  - inappropriate modification and upscaling of traditional processes in order to accelerate ripening and to reduce costs
- Control of *Listeria monocytogenes* remains a challenge for all (!) manufacturers of smoked or „gravad“ fish products and of cheeses (both from raw and pasteurised milk) with surface smear and/or internal mould growth. Key preventive measures include:
  - Separation of “clean” from “unclean” processes
  - Proper cleaning and disinfection
  - Limitation of shelf life
- Botulism became rare as home preservation of food decreased. However, problems may arise if products and processes are modified without proper understanding their basis and hazards associated.
Conclusions (II)

- EU regulations on food safety must be implemented in a flexible, risk-based way: problems are merely caused by national or local interpretation rather than by the regulations per se.

- Operators of SME should be aware of this flexibility and know sources of information needed to argue with official food control, customers and auditors. But they should also know that an effective „slim“ food safety management is in their own interest.
Thanks to …

- all people that have been involved in my own research on traditional meat products
- Peter Zangerl, Federal Institute for Alpine Dairying, BAM), 6200 Jenbach/Rotholz 50a, Austria, for the pleasant and efficient cooperation in preparing the publication (Lücke & Zangerl, Food Control 43 (2014) 217-230) on which this presentation is based

Thank you for your attention!