

# SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI* (STEC) IN DRY SAUSAGES

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## Introduction

Using good manufacturing technologies long fermented dry sausages do not pose a health hazard to the consumer (Kofoth, 1998). In September 2004 a recall was started for STEC-contaminated salami products (EU-rapid alert, 2004). The recall affected plant produced mould-ripened salami products under ecological points of view (without nitrite). The aim of this study was to investigate the reasons for the recall action by analyzing products of the recall affected plant and products from retail and studying the survival of STEC in salami products with and without nitrite.

## Materials and Methods

Product samples (35) from the recall-affected manufacturer and 100 salami products bought during October and December 2004 in Bavarian retail markets were analyzed for *E. coli* counts, STEC and other parameters as shown in Table 1.

**Table 1:** Material and methods for analysis of samples used in this study.

Materials	
Samples from recall affected plant	35 different kinds of dry sausages (mould-ripened, without nitrite)
Samples from retail markets	100 long fermented dry sausages (no products without nitrite available)
Samples from inoculation study	Sausage samples from produced batches (see table 2) at different stages of ripening (day 0, 2, 3, 6, 9, 14, 21, 28, 35, 42)
Methods	
Analysis according to German food legislation (LMBG, 1997)	pH-value aw-value (only in control batch) <i>Enterobacteriaceae</i> counts (DHL-Agar [Merck, Germany], 24h, 37°C) <i>E. coli</i> counts (ECD [Merck, Germany], 24h 37°C) Qualitative STEC detection by PCR (Karch and Meyer, 1989)

To study the survival of *Enterobacteriaceae* and STEC in salami processed with and without nitrite, three batches of mould-ripened salami were produced using standard manufacturing technologies: batch 2 with 2.8% sodium chloride (NaCl) and batch 3 (with 2.8% nitrite curing salt) were inoculated with pool of *Enterobacteriaceae* and STEC. The nitrite curing salt was composed of 99.5–99.6% sodium chloride and 0.4–0.5% sodium nitrite. The *Enterobacteriaceae* inoculum was a pool of *Escherichia coli*, *Enterobacter liquefaciens* and *Proteus mirabilis*. For the STEC inoculum three strains were used, which have been isolated from products of the recall affected plant (serotypes: Ont:H42, O22:H8, O100:H-). The survival of the inocula was observed during the ripening of the sausages (see Table 2). Batch 1 was produced with 2.8% NaCl and taken as negative control.

**Table 2:** Materials, composition, inoculation doses and ripening programme for the inoculation study.

Composition:	Meat	Spices and additives		
	33% pork	0.2% Glucose	0.04% Nutmeg	0.03% Cardamom
	33% beef	0.3% Pepper	0.03% Ascorbate	0.03% Coriander
	30% pork lean fat	0.05% Paprika		
Starter cultures:	Biostart [Raps, Germany], Bactofem <sup>TM</sup> ( <i>Penicillium nalgiovense</i> [CHR HANSEN])			
Produced batches	Batch 1 + 2.8% NaCl (control batch)	Batch 2 + 2.8% NaCl 10 cfu/g STEC 4 log <sub>10</sub> cfu/g <i>Enterobacteriaceae</i>	Batch 3 + 2.8% nitrite curing salt** 10 cfu/g STEC 4 log <sub>10</sub> cfu/g <i>Enterobacteriaceae</i>	
Ripening programme				
Temperature (°C)	Day 0-1: 23	Day 2: 22	Day 3-5: 20	Day 6-21: 18
Rel. humidity (%)	Day 0: 95	Day 1-2: 93	Day 3-4: 90	Day 5-19: 88
			Day 20-26: 85	Day 27-42: 80

\*\*nitrite curing salt: composed of 99.5 – 99.6% NaCl and 0.4 – 0.5% NaNO<sub>2</sub>

## Results and Discussion

About 9% of the samples from the recall affected plant were found to be STEC positive. In 3% of the samples, *Enterobacteriaceae* up to 5 log<sub>10</sub> cfu/g were counted. *E. coli* counts were up to 3 log<sub>10</sub> cfu/g. The microbiological analysis of salami products from retail markets showed counts below 10 cfu/g and no STEC in the samples. The inoculation study resulted in a survival of STEC over six weeks in sausages produced without nitrite.

*Enterobacteriaceae* counts decreased until the end of ripening to 100 cfu/g (see Figure 1).

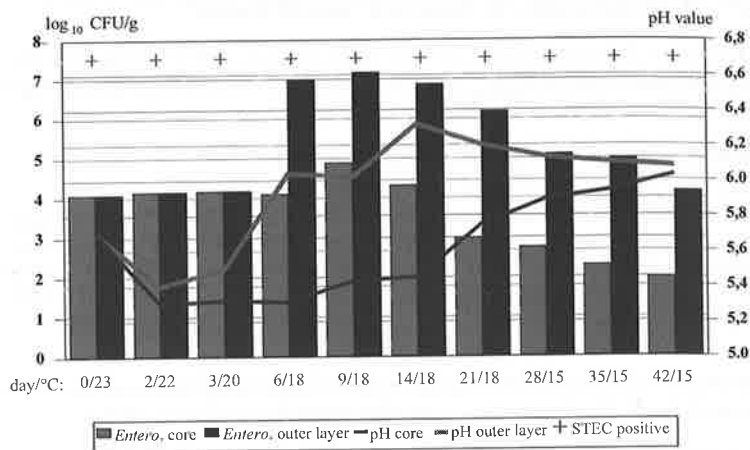


Fig. 1: Survival of STEC and *Enterobacteriaceae* in mould-ripened sausages, produced with 2.8% NaCl (composition and inoculation doses see tab. 2).

In sausages with 2.8% nitrite curing salt, STEC were detected until to the third week of ripening and *Enterobacteriaceae* counts fell under 10 cfu/g (see Figure 2).

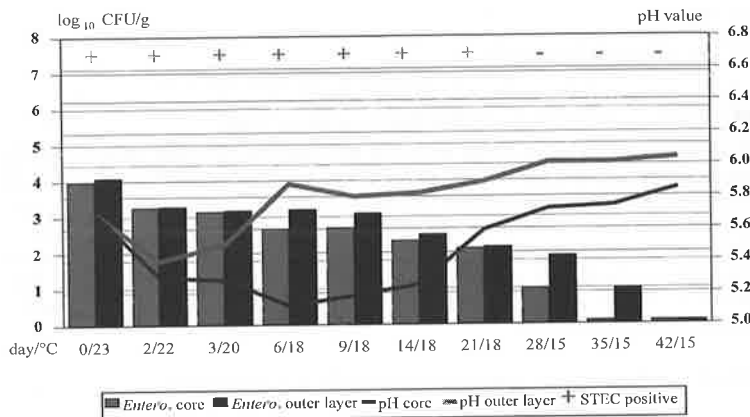


Fig. 2: Survival of STEC and *Enterobacteriaceae* in mould-ripened sausages, produced with 2.8% nitrite curing salt (composition and inoculation doses see tab. 2).

### Conclusions

According to these results, the cause of the recall for STEC contaminated salame products in 2004 in Germany was a deficient hygiene-management in the affected plant. Using good manufacturing technologies long fermented dry sausage does not bear a risk to consumer's health. The processing of salami products without nitrite should be done under strict compliance of hygiene regulations.

### References

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