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## **A Risk Assessment of Shiga Toxin-producing *Escherichia coli* (STEC) in the Norwegian Meat Chain with Emphasis on Dry-cured Sausages**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/EJNFS/2021/v13i430404

**Grey Literature**

**Received 10 May 2021**  
**Accepted 17 July 2021**  
**Published 30 July 2021**

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### **ABSTRACT**

*E. coli* is part of the normal gastrointestinal microbial flora of humans and animals. *E. coli* bacteria causing enteric/diarrhoeal disease are categorized into different groups based on their virulence properties and pathogenic features in humans. Enterohaemorrhagic *E. coli* (EHEC) are *E. coli* strains that cause bloody diarrhoea and haemolytic uraemic syndrome (HUS) in humans, and have a defined zoonotic association. The major virulence factor of EHEC (and the actual cause of HUS) is the ability to produce Shiga toxins (Stx), thus the name Shiga Toxin Producing *E. coli* (STEC). With enteropathogenic *Escherichia coli* (EPEC), the diarrhoea in these patients is due to attaching and effacing (A/E) lesions in the enteric epithelium.

This risk assessment was conducted after a human outbreak of STEC O103 in 2006, associated with contaminated dry-fermented sausages.

The Norwegian Scientific Committee for Food Safety (Vitenskapskomiteén for mattrygghet), Panel on Biological Hazards, was asked by the Norwegian Food Safety Authority (Mattilsynet) for a

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risk assessment regarding shiga toxin-producing *E. coli* (STEC) in the Norwegian meat chain, with emphasis on dry-cured sausages. In response, an ad hoc Working Group of experts was appointed with the mandate to draft a risk assessment regarding this issue.

The current report approaches the task by following and analysing the entire process, from the origin of the meats at farm level, to the final production and storage of dry-cured sausages. An overall aim of the report has been to identify and describe potential intervention options in various parts of this chain.

**The main conclusions from the risk assessment are as follows:**

1. It is not possible to give any reliable quantitative estimates of the current risk associated with consumption of dry-cured sausages.
2. There are no clear indications of any general change in the epidemiology of STEC infections in humans in Norway over the last decade.
3. There is no documentation that there has been any change in the occurrence of various STEC in the domestic animal reservoir during the last decade.
4. The combination of proper slaughter hygiene and use of thermal decontamination of sheep, cattle and pig carcasses represents an efficient way to reduce STEC contamination. This approach would not only cause a reduction in the contamination level of STEC, but also provide a general beneficial effect on the level of other enteric pathogens, such as Salmonella and Yersinia enterocolitica.
5. Proper use of starter cultures in fermentation, combined with higher fermentation temperatures, will reduce the probability of growth of STEC in contaminated drycured sausages.
6. A combination of higher fermentation temperatures, a lower pH during the process, and heat-treatment of the final product should effectively eliminate the potential risk for transmission of STEC infections from consumption of dry-cured sausages. A 5 log reduction is possible.
7. Technological options are available to reduce significantly the transfer of potential pathogens through meats in general, and specifically through dry-cured sausages.
8. The most important data gap is the lack of information about the actual occurrence of STEC infections in humans in Norway. Improved laboratory diagnostic procedures and epidemiological surveillance, combined with better reporting and tracing in the health care system are necessary.
9. The implementation of properly designed base-line studies of various domestic animals, to provide data on the occurrence of various serotypes and their virulence factors present is recommended. Also, this would provide a better basis for comparison with human isolates.

*Keywords: The Norwegian Scientific Committee for Food Safety; the VKM; STEC.*

Available: <https://vkm.no/download/18.13735ab315cffeccb51ffbc/1501002588432/1b1d63d5e9.pdf>

**NOTE:**

This work was carried out in collaboration between all authors. The opinion has been assessed and approved by the Panel on Biological Hazards of VKM. All authors read and approved the final manuscript.

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**Suggested citation:** VKM. 2007. A risk assessment of shiga toxin-producing *Escherichia coli* (STEC) in the Norwegian meat chain with emphasis on dry-cured sausages. Scientific Opinion of the Panel on biological hazards of the Norwegian Scientific Committee for Food Safety, Oslo, Norway.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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