Assessment of the human risk associated with use of pork with potential presence of multi-resistant Salmonella Typhimurium DT104 for bacon production

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Summary: We examined whether pork with suspected content of Salmonella Typhimurium DT104 (DT104) could be used for production of bacon without jeopardizing consumer safety. The results of the risk assessment showed, that if Salmonella is present in raw pork, it is usually in low numbers. Additionally during processing an eventual presence of Salmonella will be distributed (equalized) within the product. The processing will stabilize the product against growth of Salmonella, and finally, the product is heat-treated before consumption. Nevertheless if high numbers of Salmonella are present in bacon, there is a risk of cross-contamination at consumer level. Therefore, we have developed a monitoring and risk managing program to control the amount of Salmonella in the final product, e.g. bacon. Compared to the current system in Denmark, the suggested program implies a far better and more systematic monitoring providing a higher degree of food safety.

Keywords: Risk assessment, food safety

Introduction: Salmonella Typhimurium DT104, multiresistant, (DT104) is a specific type of Salmonella, which is unwanted in products for human consumption because of its ability to cause disease in humans and specially due to its antibiotic resistance. By monitoring domestic produced pork with subsequent tracing, infected herds might be identified. Likewise, monitoring imported pork will identify DT104. We wanted to examine whether pork with low content of DT104 could be used for bacon. Bacon was considered because it is known to stabilize the amount of Salmonella spp. due to the presence of salt and nitrite, and furthermore, bacon is heat-treated before consumption. In 2000, the Danish Veterinary and Food Administration asked the Danish Bacon and Meat Council to undertake an assessment of the human risk associated with use of pork with potential presence of multi-resistant Salmonella Typhimurium DT104 for bacon production. By use of
the risk assessment a proposal was outlined for monitoring and use of different groups of pork. Hereby, it was the intention to improve surveillance and food safety in an economically efficient way. The paper describes in short how the qualitative risk assessment was carried out and how the monitoring scheme was derived.

Materials and Methods: We assessed whether bacon produced by pork with low prevalence of DT104 would jeopardize consumer safety. A qualitative risk assessment was undertaken based on data from 1) the Danish national surveillance and control program for Salmonella in pork, 2) meat processing plants and pilot plant studies, as well as 3) knowledge about the processing technique. Data for Salmonella spp. as such were used due to the lack of detailed data for DT104.

Results: The assessment showed that if Salmonella is present, it is usually in low numbers (in more than 50% of Salmonella positive carcasses from high risk herds (level 3), there are less than 0.014 salmonella bacteria pr. cm², and in the rest of the samples from high risk herds there are less than or around 0.14 bacteria pr. cm², Olsen et al., 2001). Additionally during processing an eventual presence of Salmonella will be distributed (equalized) within the product. Additionally, the processing will stabilize the product against growth of Salmonella (Lstrup, 1994 and 1995, Larsen, 1998), and finally the product is heat treated before consumption.

The results are supported by the producers’ own control results:
• Raw meat/injection brine: 5% Salmonella positive samples (in total 1,104 samples of 25 g)
• Bacon: 0.03% Salmonella positive samples (in total 16,500 samples of 25 g)

Discussion and conclusion: The results of the risk assessment showed:
• If Salmonella is present in raw pork, it is usually in low numbers.
• Additionally during processing an eventual presence of Salmonella will be distributed (equalized) within the product.
• The processing will stabilize the product against growth of Salmonella.
• The product is heat treated before consumption.
• The results are supported by the producers’ own control data: Salmonella spp. will only occur seldom in bacon.

However, if higher numbers are present disease might occur. Therefore, we suggest a general monitoring scheme, where 60 samples (meat or carcasses) are taken and analysed for DT104 in 12 pools of five samples each. In case of carcasses,
1,400 cm\(^2\) should be swabbed. If all pools are negative, we assume the prevalence is negligible – and this pork might be sold directly to the consumers. If 1 or 2 pools are positive we assume that there is a low prevalence and we suggest that this pork might be used for bacon production. In case >2 pools are positive, the prevalence may be high – and the pork must be heat-treated. The entire batch or all carcasses from the same herd is evaluated based on this scheme. However, carcasses in negative pools may be sold directly to the consumers even though they formed part of a positive test round for a herd. The suggested scheme implies a far better and more systematic monitoring than the current Danish system. This means an increased sensitivity and, hence, ensures the consumer a higher degree of food safety.

Regarding the process, it must be controlled and documented (according to HACCP principles), that salt in water-phase is at least 3\% and adding of 60 ppm nitrite.

**Epilogue:** The Danish Veterinary and Food Administration is currently considering whether to accept the suggested monitoring and management scheme. During autumn 2001 a decision will be taken, which could include slight modifications to the suggested system.

**References**
Lstrup, K., 1994 og 1995: Prevalence of Salmonella in raw, cured and smoked meat (I and II, in Danish). Ref. No. 05.452 5. Ref. nr. 05.452. Danish Meat Research Institute, Roskilde, Denmark.