

Quantitative risk assessment for *Escherichia coli* O157:H7 in frozen beef burgers consumed at home in France by children under the age of 16

Summary

Epidemiological studies conducted in France show that beef burger consumption is the main risk factor of a serious disease caused by Shiga toxin-producing *Escherichia coli* bacteria or STEC, haemolytic uraemic syndrome (HUS). Accordingly, to complete the report on Shiga toxin-producing *Escherichia coli* bacteria, published by Afssa in 2003, the working group was entrusted with carrying out a quantitative risk assessment for the consumption of beef burgers containing STEC.

The procedure followed was the one recommended by Codex Alimentarius: since the hazard had already been identified in 2003, the group worked on assessing exposure (the purpose being to find out the quantity, or dose, of STEC to which consumers are exposed), effects (the purpose being to find out the response, i.e. the likelihood of a morbid effect, depending on the dose) and the risk (estimation of the number of cases of morbid effect studied in the population).

To carry out this assessment, the working group used bibliographical data and also had to obtain any missing data (particularly on consumption). It therefore conducted a survey of beef burger consumption in young children and measured the thermal destruction during cooking under experimental conditions. The group was then able to construct new dose-response relationships (creating a link between the ingested dose of micro-organisms and the health effect) particularly for young children. The relationships published previously at international level did not correspond to the *E. coli* O157:H7 epidemic that occurred in France in 2005.

The working group focused on the data available for France, which enabled them to estimate a contamination level of raw beef burgers at $5 \cdot 10^{-5}$ STEC per gram in a non-epidemic situation and around 100,000 times higher (i.e. 5 STEC per gram) during the 2005 epidemic.

After exploiting the consumption data, it appears that almost 50% of children under the age of 5 eat well-done beef burgers (as well as 29% and 24% of 5-10 year olds and 10-15 year olds respectively). The proportion of beef burgers consumed rare increases with the children's age: 10%, 17% then 20% for each of the age groups defined (under 5, 5-10 year olds and 10-15 year olds). Regarding the effectiveness of cooking (a frozen beef burger being pan-fried and turned over once), it should be noted that cooking "rare" is associated with a percentage of STEC destruction of 0% to 87% ; "medium" 37% to 96% and "well done" 94% to 99.8%. Concerning the consumption habits that prevail in French households today, these results highlight the importance of the length of cooking on STEC destruction (currently not enough), and the hygiene of beef burger production.

In order to help the ministerial departments in their decision-making on HUS risk management, the working group has produced a graph and a formula for an approximate calculation of the average probability of developing a HUS depending on the pathogen

concentration in the frozen meat, following the consumption at home of a beef burger bought frozen from the French food industry.

The three striking facts of this report are that this work:

- presents the first quantitative risk assessment conducted in France on this pathogen;
- establishes the first mathematical model applied to French data;
- carries out an exhaustive assessment of not only available data, but also data that still needs to be obtained.