Assessing interventions to reduce the risk of human salmonellosis from fresh pork meat in Belgium

L. Delhalle, 1* K. Bollaerts, 2 W. Messens,.3 K. Grijspeerdt, S. Van der Stede, J. Dewulf, D. Maes, I. Boone, K. Mintiens and G. Daube, 1

1 University of Liege - Faculty of Veterinary Medicine - Food Science Department - Sart-Tilman, Bât B43bis, 4000 Liege, Belgium
2 Ghent University - Faculty of Veterinary Medicine - Department of Veterinary Public Health and Foodsafety - Salisburylaan 133, 9820 Merelbeke, Belgium
3 University of Liege - Faculty of Veterinary Medicine - Animal Production Department – Biostatistic, Economy and Animal Selection - Sart-Tilman, Bât B43bis, 4000 Liege, Belgium

*Corresponding author : l.delhalle@ulg.ac.be

Introduction

The risk of human salmonellosis through the consumption of minced pork meat in Belgium was assessed via a modular risk model, called the METZOON model, covering the pork meat production from farm to fork (1). One of the goals of the METZOON model was to give concrete options in the pork meat chain to reduce effectively the risk of human salmonellosis.

Scenario analysis

The aim is to identify combinations of input which lead to output target values (2). This is achieved by selecting various combinations of input values commonly know as “what if scenario” (3). First the outputs data of each module of the METZOON model were comparing with data collected through studies and official monitoring plans in Belgium in order to validate the suitability of the model for the Belgian situation. Then, scenarios were elaborated in regard of the international situation and the literature to give concrete and realistic possibilities to improve the microbiological quality of the pork meat and to reduce the number of human salmonellosis cases per year in Belgium. Ten scenarios were introduced in the METZOON model and covered the entire pork meat production from primary production until preparation at home. These scenarios were either the application of one punctual action or the implementation of several measures simultaneously.

The effect of changing parameters for selected influential variables was assessed for the normal and susceptible population (commonly called the YOPI (young, old, pregnant, imunocompromised) group) using the following simulation scenarios:

1.• **Baseline results**: the model was performed without changes to show the results of each module

2.• **Reduced proportion of sero positive pigs at the end of the primary production**: this scenario reduced of 25, 50 and 75% the serological prevalence of the finishing pigs in the model.

3.• **Increased efficacy of singeing**: the reduction of the bacterial contamination equal 95% with a double singeing between sticking and evisceration.

4.• **Increased efforts both at primary production and at the slaughterhouse**: This scenario reduced of 25, 50 and 75% the serological prevalence of the finishing pigs and 95% of the carcass contamination with double singeing between sticking and evisceration.

5.• **Reduced probability of contamination at evisceration**: This scenario reduced the contamination of 25, 50 and 75% of the carcass at evisceration

6.• **Reduced prevalence at the end of slaughterhouse**: this scenario reduced of 25, 50 and 75% the prevalence of pig carcasses at chilling

7.• **No growth of *Salmonella* between retail and home**: All temperatures are fixed at 5°C. This scenario can reflect a perfect control of the cold chain during transport and storage at home

8.• **Reduced probability of cross-contamination during handling at home**: the probability of cross contamination was simulated with 25, 50 and 75% of reduction with the current value of the model.

9.• **Reduced probability of under cooking at home:** Probability of under cooking was simulated with 25, 50 and 75% of reduction with the current value of the model.

10.•**Increased efforts along the production chain:** This scenario use a reduction of 50 % from the actual sero-prevalence in the model, 95% of reduction of *Salmonella* contamination with double singeing between sticking and evisceration, all the temperatures fixed at 5°C during transport and storage at home, reduced probability of 50% of cross contamination and under cooking at home.

Table 1: Final Risk of human salmonellosis based on the scenario n°2 (reduction of sero positive pigs at the end of the primary production

	Normal population		Susceptible population	
Reduction (%)	**Mean**	**Variance**	**Mean**	**Variance**
0	0,00028	0,00011	0,00124	0,00046
25	0,00017	0,00007	0,00102	0,00032
50	0,00015	0,00006	0,00085	0,00029
75	0,00013	0,00005	0,00074	0,00025

Results and Discussion

The scenario n°2 was chosen as an example to show the results of the scenario analysis (cfr table 1). The average risk for the normal and the susceptible population is equal to 280 and 1240 salmonellosis every million of pork meat portions, respectively. The final risk is 4 to 6 times higher for the susceptible population compared to the normal population. If the serological prevalence of the finishing pigs at farm level is reduced of 25% then the risk is decreased of 40% for the normal population and 18% for the susceptible population. The reduction of 50% and 75% for the normal population give a decrease of the final risk but not with the same magnitude than the reduction of 25%.The reduction of 75% decrease 40% the risk for the susceptible population. To obtain a decrease of 40% of salmonellosis for the susceptible population, the sero prevalence of finish pigs must be reduced of 75%.

Conclusions

This quantitative microbial risk assessment permit to measure the efficacy of interventions along the pork meat production chain. The microbiological quality is very important especially for the YOPI group who have a risk of salmonellosis much higher than the normal population. A reduction of 25% of the sero prevalence of finishing pigs can give a good decrease of the final risk of human salmonellosis in Belgium . But these results must be compared to other scenarios in order to give the more feasible and efficient options to decrease the risk. Scenario analysis could contribute to the development of new performance objectives for use in the pork meat chain, thereby ensuring an improvement in the quality of pork products.

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