Assessment of microbiological criteria for regular checks of faecal contamination and general hygiene in Belgian establishments producing meat

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Introduction

The faecal contamination is likely the main source of potential human pathogens including *Salmonella, Campylobacter* and enterohemorrhagic *Escherichia coli* on animal carcasses and in meat. Leakage from the gastrointestinal tract or contact with the animal skin could cause widespread contamination. In warm-blooded animals, the best indication of faecal contamination is *Escherichia coli*. This microorganism is widely present in the gastrointestinal tract and survives under refrigerated conditions but temperatures below 7°C prevent its growth.

The USDA has chosen *E. coli* as indicator of faecal contamination and the enumeration of *E. coli* has to be done mandatory for all industries commercialising meat in United States of America.

In its Decision of 8 June 2001 (2001/471/EC), the European Commission lays down the *Enterobacteriaceae* and total viable counts as regular checks on general hygiene in establishments producing and marketing fresh meat. However, after establishing appropriate criteria, E. coli counts may be used instead of *Enterobacteriaceae* counts.

The Belgian meat surveillance between 1998 and 2001 has allowed the evaluation of the sampling method and has proposed criteria for E. coli, *Enterobacteriaceae* and total plate counts.

Material and Methods

Since 1998, the Belgian surveillance program has assessed the contamination with *E. coli* of meat from beef, pork, layers, broilers, turkeys and fish. The following matrixes were sampled for *E. coli*:

- swabs of: beef and calf carcasses (4 zones on a half beef carcass for about 400 cm^2 in 1998 and 1600cm^2 since 1999), pork carcasses (4 zones on a half pork carcass for about 600 cm^2)
- minced meat of beef, retail cuts and minced meat of pork, skin and boneless breast of broilers, skin of layers and turkeys and, in 2000 meat products (ham, pâté, salami).

In 2001, the contamination level of beef and pork carcasses, and meat products with *Enterobacteriaceae* has been assessed. In 2001, the total plate count was also realised from beef and pork carcasses.

The *E. coli* count (in cfu/g or cm^2) has been realised with the AFNOR validated SDP-07/1-07/93 using the chromogenic Rapid E. coli 2 medium (Bio-Rad) with an incubation during 24h at 44°C. The total plate count followed the NF-V-08-051 method (PCA at 30°C during 48-72h) and the enumeration of *Enterobacteriaceae* was realised using the NF-V-08-054 method (VRBG at 30°C during 24h).

Results and discussion

This study of *E. coli* contamination allowed the estimation of the sanitary level of Belgian companies and the follow-up of each establishment since 1998. In poorly contaminated matrixes (cattle and pork), as a general rule, the prevalence of pathogens is directly linked to the *E. coli* level of the establishment. This in not the case for poultry, which is highly contaminated with *Salmonella* and *Campylobacter*.

The proposed criteria for *E. coli*, *Enterobacteriaceae* and total plate counts are based on the percentiles 75 and 95 of the screening plans of 2000 and/or 2001 and are showed in Table 1. The criteria for pork and bovine carcasses (Fig. 1) are these of the Belgian legislation, according to the Decision of 8 June 2001 (2001/471/EC). The representation of the *E. coli* percentiles from 1998 to 2001 (Fig. 2-9) is showing that the fecal contamination in Belgian establishment is stable and the monitoring plans representative of the Belgian situation.

The determination of the correlation between *E. coli*, total plate count and *Enterobacteriaceae* in beef and pork carcasses (Fig. 10-12 : example of beef carcasses) showed that there is a clear relation between *E. coli* and *Enterobacteriaceae* counts, but that there is no relation between the counts of *E. coli* or *Enterobacteriaceae* and the total plate counts.

Because of the specificity of *E. coli* as faecal indicator and of the fact that the *Enterobacteriaceae* counts are integrated in the total plate count, the *E. coli* and total plate counts have been chosen respectively as faecal and global hygienic indicators for beef and pork carcasses.

For meat products (ham, pâté, salami), the *E. coli* level in 2000 was very low; the *Enterobacteriaceae* count was then chosen as hygienic indicator for these products.

Fig. 1: Belgian microbiological criteria for E. coli and total viable counts : beef and pork carcasses

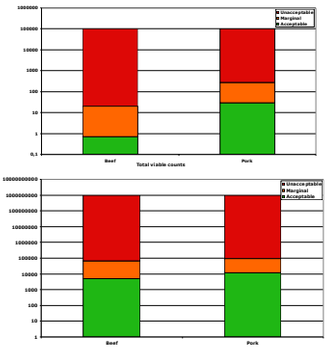


Table 1: Percentiles 75 and 95 for E. coli and Enterobacteriacea for the Belgian meat production

Table 1 : Proposed criteria for the Belgian meat production (cfu/cm^2 or g)

		E. coli		*Enterobacteriacea*	
		P75	P95	P75	P95
Beef	minced meat	$1{,}8\ 10^1$	$5{,}0\ 10^2$		
Pork	retails cuts	$2{,}6\ 10^2$	$6{,}5\ 10^3$		
	minced meat	$9{,}3\ 10^1$	$2{,}8\ 10^3$		
Broiler	skin	$2{,}0\ 10^4$	$7{,}5\ 10^5$		
	breast	$5{,}3\ 10^2$	$5{,}5\ 10^3$		
Layer	skin	$1{,}3\ 10^4$	$2{,}9\ 10^5$		
Cooked products	ham			$3{,}3\ 10^1$	$5{,}1\ 10^3$
	pâté			$1{,}0\ 10^1$	$8{,}6\ 10^3$
	salami			$1{,}0\ 10^2$	$1{,}5\ 10^3$

Fig. 2 - 9 : Representation of the limits and distribution of the percentiles for E. coli in beef, pork and poultry (1998-2001)

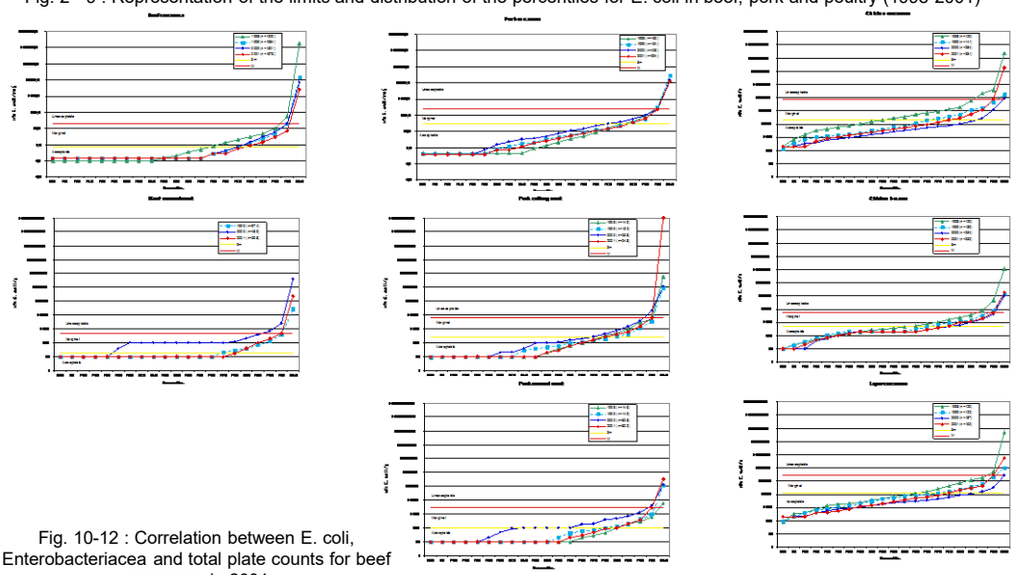
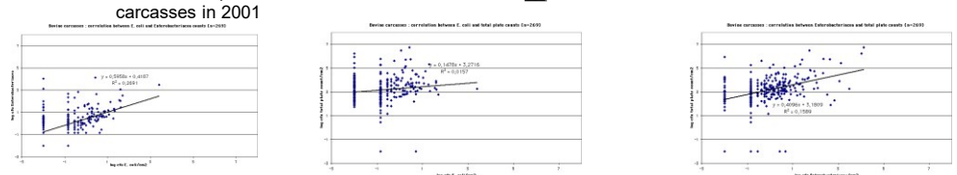


Fig. 10-12 : Correlation between E. coli, Enterobacteriacea and total plate counts for beef carcasses in 2001



Conclusion

E. coli and total plate counts are a good mean to evaluate hygienic measure efficacy in meat industry, especially for abattoirs. For internal quality control, companies should use the same sampling method and criteria. They will allow an evaluation of the contamination level of each industry, and of preventive measure efficacy.

This study was financially supported by the Institute of Veterinary Expertise (Public Health).