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# RELATIONSHIP BETWEEN SURFACE CARCASSES AND MINCED MEAT CONTAMINATIONS UNDER FRENCH PRODUCTION CONDITIONS

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Please refer to Folio 39.

## INTRODUCTION

The microbial quality of meat products is a multi-factorial problem. The microbial quality of the raw material (carcasses), maintenance of the cold chain and the sanitary conditions throughout the production process are known to be important factors in determining the microbial quality of meat products. However, the relative importance of those factors has not been established. For minced meat, which generally has higher bacteriological counts than others cuts of meat, contradictory results have been published ; Field *et al.* (1977) and Greer and Jeremiah (1980) showed that the quality of the raw material is more important than the conditions during processing. On the other hand, Nortje *et al.* (1989) recently found that sanitary conditions during production may be the most important factor in determining minced meat quality. In this study, an attempt was made to relate the microbial quality of the raw material and that of the final product for batches of French minced meat.

## MATERIALS AND METHODS

To study the relationship between carcass and minced meat contamination over a wide range of production conditions, 10 French factories were visited on three or four occasions. In each factory, samples from nine to 20 batches of mince were collected (see below), so that a total of 91 batches of mince meat were monitored. Each batch was made with muscles from about 20-30 fore quarters to give about 500kg minced meat containing 15% fat.

### Sampling of carcasses

For each batch, 12 fore quarters were randomly selected and sampled by excision just before deboning. Excision samples (12,5cm$^2$) were shaved off as thinly as possible with sterile instruments at three defined sites (shoulder, neck, fore rib), as previously described (Cartier, 1992). Samples from the same quarter were bulked, packed in a sterile bag and frozen.

### Sampling of minced meat

At the end of the production process, five samples of minced meat (5-10g) were collected from the mincer, packed in a sterile bag and frozen.

### Bacteriological analysis

The samples were blended (stomacher 80) for 1.5 minutes in 50ml (carcass samples) or nine volumes (minced meat samples) of 0.1% peptone water. Decimal dilutions were prepared and 1ml samples were plated on media and

incubated. Total Viable Counts (TVC) were determined on TVG 5 P (Fournaud *et al.*, 1973) after incubation for five days at 22°C. For *pseudomonas* (PS) counts, samples were incubated for two days at 22°C, using *pseudomonas* Agar Base (Oxoid) and *pseudomonas* C.F.C. Supplement (Oxoïd). *Enterobacteriaceae* (Eb) were enumerated on Violet Red Bile Agar (Oxoïd) after incubation for one day at 30°C.

All counts were transformed to logarithms and expressed as log 10 CFU (Colony Forming Unit) per $cm^2$ (carcasses samples) or per g. (minced meat samples).

## RESULTS AND DISCUSSION

The microbiological quality of the 91 batches of carcasses used in minced meat production is tabulated in Table 1. TVC, PS and Eb counts (log 10/$cm^2$) showed large variations from one batch to another (TVC:2.93-6.14; PS:0.48-5.30; Eb:0.48-3.75).

A wide variability in the microbial loads on beef carcasses have previously been reported in many studies (Roberts *et al.*, 1980a; 1984; Nortje and Naudé, 1981; Johanson *et al.*, 1983; Simard *et al.*, 1984). The reason for such extreme differences is not understood, as many factors are known to affect contamination of carcasses during slaughter and storage under chilled conditions (Ingram and Roberts, 1976; Roberts, 1980; Eustace, 1981).

In the present study, it should be noted that the carcasses were frequently commercial carcasses. Consequently, several batches sampled at the same factory came from several slaughterhouses. Furthermore, the time between slaughter and sampling was not the same for all batches; in some cases this time was only 1 day, but in other cases carcasses had been cold-stored for four to five days. Those two factors (differences in slaughter practices and in the duration of cold-storage) probably contributed to variability observed here. In particular, batches of carcasses that had been cold-stored for four to five days showed higher PS counts than the others (results not shown).

In minced meat, the range of counts between batches was also very large (Table 1). For example, with TVC as the bacteriological index, the maximum and minimum counts differ by 2.6 logarithmic units. A large part of this variability is explained by the hygienic quality of the raw material (see below). The average contamination of the minced meat examined here was lower than that reported in others published surveys (Roberts *et al.*, 1980b; Hudson *et al.*, 1986). An explanation may be that the samples of minced meat studied here were collected just after production, while in other studies those samples were frequently purchased from supermarkets or butcher's shops.

The relationship between carcass and minced meat contamination is shown Figure 1. These graphs indicate that the quality of the final product is highly related to the quality of the raw material. The correlation coefficients (r2) for TVC, PS and Eb were, respectively, 0.61, 0.68, 0.65.

Linear regression equations obtained with TVC and PS were similar (TVC:Y=0.64X+1.69; PS:Y=0.64 X+1.80; where Y contamination of final products and X contamination of carcasses). The equation calculated for Eb counts was different (Y=0.90X+1.06). The reason for that difference was not understood.

## CONCLUSION

The present study clearly shows that under French production conditions, the microbial condition of the raw material is the most important factor determining the microbial quality of minced meat.

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Table 1. The microbiological quality of 91 batches of carcasses and the minced meat produced from each batch.

| | Raw Material (beef carcasses) Min | Max | Mean ± SE | Final Product (minced meat) Min | Max | Mean ± SE |
|---|---|---|---|---|---|---|
| Total viable counts | 2.93 | 6.14 | 3.97 ±0.70 | 3.41 | 6.00 | 4.25 ±0.58 |
| Pseudomonas | 0.48 | 5.30 | 2.31 ±1.18 | 1.49 | 5.79 | 3.28 ±0.92 |
| Entero-bacteriaceae | 0.48 | 3.75 | 1.37 ±0.94* | 0.95 | 4.60 | 2.30 ±0.83* |

*: n=65.