14 TH EUROPEAN MEETING
OF MEAT RESEARCH WORKERS
BRNO. CZECHOSLOVAKIA AUGUST 26th – 31st 1968

SECTION A 3

J. T. Patterson

United Kingdom

# Hygiene in Meat Processing Plants - Methods of Reducing Carcase Contamination.

## Introduction

The most important sources of bacterial contamination on the carcases have been reviewed, Patterson (1967), where the importance of having clean animals for slaughter was stressed. However, during the butchering operations carcases become contaminated with bacteria to a greater or lesser extent, depending on the methods employed in the abattoir, and the condition of the animals on arrival. Ideally there should be little bacterial contamination transferred to the carcases during butchering, but under practical conditions this is difficult to achieve. Livestock are often dirty, sometimes with an accummulation of faeces on the hide or fleece, and may also be wet if the time spent in the lairages is too short.

The purpose of this paper is to outline some of the precautions which can be taken to reduce such contamination to a minimum before the carcase enters the cooling-room. The initial bacterial contamination on the carcase is an important factor in the onset of sliminess and off-odours. The greater the bacterial load after butchering the more likely is the quick onset of these defects.

Experimental Methods

The use of wiping cloths on carcases was prohibited in N. Ireland abattoirs from 1st December 1965. Clean wiping cloths, properly used can be quite effective in removing gross contamination from t e carcase and have a drying effect which physically removes bacteria. However in practice the opposite often happened and carcases became more contaminated due to their use. Various alternatives were tried experimentally with sheep carcases to find an effective substitute viz:-

(i) Washing each carcase with 6 - 7 l. of cold or hot water (80°C) under pressure using a stirrup-type pump.

(ii) Washing with cold or hot water (80°C), with less pressure, while at the same time brushing the surface with a small nylon brush.

(iii) Washing with the abattoir water jet at 50°C together with brushing with a rubber horse-brush; and this treatment combined with drying off with two absorbent paper towels each 60 x 45 cm.

(iv) Washing with cold water together with brushing with the rubber brush on the normal butchering line; and this treatment combined with drying off with three paper towels.

These carcases were sampled by swabbing all over the outer surface with three replicate small cotton-gauze swabs. Total counts were obtained on nutrient agar incubated for 3 days at 22°C after shaking the swabs in 0,5 per cent peptone water for 5 minutes. The results of these experiments are summarized in Table 1.

The experiment on drying off sheep carcases with three paper towels was repeated in another abattoir. In this case carcases were taken at random from the normal butchering line after they had received a final wash by a pressure

hose with water at about 50°C. The carcases were sampled by triplicate swabbing with three cotton-gauze swabs, of 16 sq. cm. areas on the rump, brisket and foreleg, using the methods outlined by Patterson (1968a). The results of this experiment are given in Table 2.

A high level of free residual chlorine in the water using in processing poultry has been found effective in lowering the initial load of bacteria on the carcases, and is a useful addition in improving general hygiene. Experience in N. Ireland has shown that up to 20 p.p.m. free residual chlorine is of great value in such plants (Patterson, 1968b), and causes no off-odours or taints in the carcases. Since the spoilage flora of meat, whether white or red is largely composed of Gram-negative species (members of the Pseudomonas-Achromobacter group) there would appear to be some merit in the use of such heavily chlorinated water on sheep and cattle carcases, to lower the initial contamination.

The work on chlorination carried out in abattoirs was done while these were operating normally. The cattle carcases were given an intermediate wash after viscera removal and a final wash with water at 40 - 50°C by two operators at the end of the line. Sheep carcases received a similar treatment. At least six cattle or fifty sheep were allowed to pass along the butchering line before starting the experimental work, to allow normal butchering contamination to build up.

On each sampling day, five carcases were sampled on the left hand side (L.H.S.) prior to cooling. The level of chlorine in all the water used on the butchering line including the wash-points was boosted to the required level with gaseous chlorine and a further five carcases sampled. Triplicate swabs were taken from 16 sq.cm. areas on the rump, brisket and foreleg, the swabs being moistened in 0,5 per cent peptone water before use. A similar

procedure was adopted for the right hand side (R.H.S.) after overnight cooling in the abattoir cooling room. The experiment was repeated at several levels of chlorination with cattle carcases, but at the 20 p.p.m. level only with sheep carcases. Details of the results obtained are given in Tables 3 and 4.

Results and Discussion

From the data given in Table 1, it can be seen that in the first experiment the differences between treatments was not significant. In the second experiment the difference between the two extreme values was just about significant, but in general the evidence for significant differences was not proven. On the other hand experiment three showed that treatment 'g' gave a significantly lower bacterial count than 'a' while 'f' was just on the borderline of being significantly smaller than 'a' and greater than 'g'. The final experiment in the series showed that treatment 'i' gave a significantly better bacterial reduction than 'h'. Subsequent work, summarized in Table 2 showed that there was a very highly significant difference between the control and paper-towel dried carcases. There was no evidence of an interaction between drying and sampling sites.

As to the use of chlorine in the water used on butchering lines, it is clear that there was a reduction in the log counts associated with its use on cattle carcases. The greatest differences occurred on the brisket and the rump and these differences were almost always significant. While the differences were in the same direction for the foreleg only half of these were significant.

Chlorination by including 20 p.p.m. of free residual chlorine in the water significantly reduced the bacterial counts on the brisket and foreleg of sheep carcases both before and after cooling and was just on the verge of significance for the rump area.

## Conclusions

There is no easy way of producing meat carcases with low numbers of bacteria present on the meat. Firstly steps must be taken to have clean dry healthy animals for slaughter. Then every precaution must be taken to prevent contamination of the carcases during butchering. If contamination does occur, then it should be removed as quickly and efficiently as possible. Some procedures such as washing with cold or hot water under pressure at various points along the butchering line are generally necessary. In addition, a help toward better hygiene in the abattoir and lower bacterial numbers on the carcases would be to chlorinate all water used to eg. 10 p.p.m. free residual chlorine. Paper towels efficiently used would be an added help in lowering contamination on sheep carcases. Finally, cooling of the carcases must be efficient to ensure that bacterial numbers are k—ept low.

## References


Patterson, J.T. (1967). Hygiene in meat processing plants. I. Importance of bacteria in meat processing plants. Rec. Agric. Res. Min. Agric. North. Ireland, 16, 13.

Patterson, J.T. (1968a). Hygiene in meat processing plants. II. Methods of assessing carcase contamination. Rec. Agric. Res. Min. Agric. North. Ireland, 17, (in press).

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Table 1

Washing and other treatments of sheep carcases

| Experiment | Treatment of carcases | No. of carcases | $Log_{10}$ bacterial number per carcase on nutrient agar at 22°C | |
|---|---|---|---|---|
| | | | Mean Value | S.E. of Mean |
| 1 | a Unwashed | 6 | 6,49 | |
| | b Cold water washed | 6 | 6,41 | 0,113 (15 d.f.) |
| | c Hot water (80°C) wash | 6 | 6,30 | |
| 2 | a Unwashed | 5 | 6,39 | |
| | d Cold water wash, brushed with nylon brush | 5 | 6,48 | 0,160 (12 d.f.) |
| | e Hot water (80°C) wash, brushed with nylon brush | 5 | 6,09 | |
| 3 | a Unwashed | 5 | 6,73 | |
| | f Washed with warm water (50°C), brushed with rubber horse-brush | 5 | 6,41 | 0,126 (12 d.f.) |
| | g As for f, plus dried with 2 paper towels | 5 | 6,11 | |
| 4 | h Washed with cold water on butchering line, brushing with rubber horse-brush | 10 | 6,43 | |
| | i As for h, plus dried with 3 paper towels | 10 | 5,88 | 0,155 (18 d.f.) |

*Table 2*

Effect of drying off sheep carcases with 3 paper towels

| Treatment of carcases | No. of carcases | $Log_{10}$ bacterial number per sq.cm. on nutrient agar at 22 °C recovered from: | | | |
|---|---|---|---|---|---|
| | | Rump | Brisket | Foreleg | Mean |
| Normal factory wash | 5 | 3,98 | 4,37 | 3,96 | 4,11 |
| Normal wash then dried off with 3 paper towels | 5 | 3,44 | 4,04 | 2,97 | 3,48 |
| Mean | | 3,71 | 4,20 | 3,47 | |

S.E. of an overall washing treatment = 0,096 (16 d.f.)
S.E. of an overall site mean = 0,118 (16 d.f.)

Table 3

Effect of chlorination of water used on cattle butchering line

| Treatment of carcases | No. of carcases | Mean $\log_{10}$ bacterial numbers per sq. cm. on nutrient agar at 22°C: Before cooling (L.H.S.) | | | After cooling (R.H.S.) | | |
|---|---|---|---|---|---|---|---|
| | | Brisket | Rump | Foreleg | Brisket | Rump | Foreleg |
| No $Cl_2$ | 15 | 3,88 | 3,81 | 3,29 | 5,12 | 4,09 | 3,33 |
| 5 ppm $Cl_2$ | 15 | 3,38 | 3,03 | 2,91 | 4,31 | 3,00 | 2,99 |
| S.E. of difference (14 d.f.) | | 0,16 | 0,21 | 0,16 | 0,26 | 0,22 | 0,17 |
| No $Cl_2$ | 15 | 3,95 | 3,69 | 3,65 | 5,56 | 4,11 | 4,49 |
| 11 - 12 ppm $Cl_2$ | 15 | 3,50 | 3,25 | 3,22 | 4,84 | 2,99 | 4,00 |
| S.E. of difference (14 d.f.) | | 0,16 | 0,21 | 0,16 | 0,30 | 0,28 | 0,31 |
| No $Cl_2$ | 20 | 4,62 | 3,61 | 3,69 | 5,57 | 3,93 | 4,34 |
| 20 ppm $Cl_2$ | 20 | 4,03 | 3,26 | 3,42 | 4,68 | 3,28 | 3,82 |
| S.E. of difference (19 d.f.) | | 0,17 | 0,17 | 0,17 | 0,22 | 0,37 | 0,35 |

Table 4

Effect of chlorination of water used on sheep butchering line

| Washing method | No. of carcases | $Log_{10}$ bacterial counts per sq. cm. on nutrient agar at 22°C: Before cooling (L.H.S.) Rump | Brisket | Foreleg | After cooling (R.H.S.) Rump | Brisket | Foreleg |
|---|---|---|---|---|---|---|---|
| Ordinary factory wash | 20 | 4,61 | 5,30 | 5,05 | 4,46 | 5,22 | 4,59 |
| Ordinary wash and 20 ppm free residual $Cl_2$ | 20 | 4,29 | 4,96 | 4,52 | 4,12 | 4,49 | 4,10 |
| S.E. of difference (28 d.f.) | | 0,164 | 0,114 | 0,161 | 0,177 | 0,164 | 0,183 |