Investigation of the efficacy, practicality and cost effectiveness of modified atmosphere packaging on campylobacter

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Back to top

Background

Campylobacteriosis is the most common cause of foodborne illness in the UK and epidemiological investigations indicate that handling and consumption of raw or undercooked poultry meat is a significant risk factor. Packing poultry in a MA with a high oxygen concentration has been suggested as a way to reduce the numbers of Campylobacter on poultry meat during storage.

Back to top

Research Approach

this project aimed to:

- review the existing literature and the current industry use of MA packing of chickens
- define the test conditions to be used in the trials
- assess the effects of currently used MA gas mixes on Campylobacter and other factors such as colour
- carry out full scale testing of a proposed new gas mix
- report the results

the trials were to be carried out on whole fresh chickens.

Back to top

Results

The review found that the vast majority of whole birds in the UK are packed in air or in a gas mix of 70% or 80% oxygen with 30% or 20% carbon dioxide. Information from the published literature indicates that gas with a high oxygen concentration increases the rate of decline in Campylobacter numbers during storage. One paper specifically identifies a mix with 80% oxygen as being optimal.

Measurements of numbers of campylobacters on breast and back skins on whole birds packed in air or MA and stored at 4°C for 3 days showed numbers to be 0.3 to 0.4 log10 cfu/g higher on the back skins. There was no evidence of a difference in the numbers of Campylobacter packed in air

or MA.

Three further trials were carried out to assess the effects of using MA on the numbers of Campylobacter on breast skin samples. In the first trial, 120 birds from three sheds were tested after packing in either air or 80%O2/20%CO2 and storing for 3 days at 4°C (Day K+3). The breast skin samples contained so few campylobacters, and some showed no indication at all, that counting was not carried out. Gas composition in the packs was measured at the time of packing and just before they were prepared for microbiological testing. Very large variations in oxygen concentration, from about 80% down to 20%, were found between different MA packs. In the second and third trial, again 120 birds were used in each trial. Campylobacter numbers were generally low, less than 2 log10 cfu/g. Neither trial showed statistically significant evidence of a difference in Campylobacter numbers on breast skins from birds packed and stored in air or MA. The results were analysed together for both air and MA packed birds to look for a relationship between the numbers of Campylobacter and oxygen concentration at Day K+3. This analysis showed only very slight evidence of a relationship. There was no evidence of a relationship when considering the birds packed only in MA.

There are a number of differences between this study and those reported in the literature and these might be the cause of the different conclusions regarding the effects of MA. Naturally contaminated carcasses were used in these trials whereas spiked carcasses were used in almost all of the work reported in the literature. A highly permeable film was used to pack carcasses in air and a low permeability film was used to pack carcasses in MA. This is industry practice. Previous studies have not used different films with different gas mixtures. A gas:meat ratio of 0.5:1 was used in the current trials as this is common industry practice. Published trials do not specify the gas:meat ratio used. The birds were packed on-line at the processing plants of one company. Considerable variation in gas compositions in the packs was found at Day K+3. Previous published trials were carried out under controlled laboratory conditions. The birds were tested for Campylobacter at Day K+3. Testing after a longer storage period might have shown an effect of MA but this is unlikely as the numbers of Campylobacter were low and would have reduced further. With the low starting levels of Campylobacter, the trials would never show very large effects of using MA compared to air.

Following the trials described above, the work was presented to a meeting of the FSA/Industry Joint Working Group on Campylobacter -Transport and Processing Subgroup. At the suggestion of the Group, a revised work plan was submitted but after assessment and review the project was terminated.

The review of the literature indicated that a high oxygen concentration in-pack, compared to packing in air, would increase the decline of Campylobacter numbers during storage. The trials and data gathered in this project indicate that the current industry practice is to pack whole birds in air or in a high oxygen gas mixture (70 or 80% O2) with a gas:meat ratio of 0.5:1. When using these conditions, no statistically significant evidence was found of an effect on the Campylobacter numbers on the birds packed in MA or air. Reasons for the lack of seeing an effect have been suggested including the large variability in gas compositions in the packs at Day Kill+3, the use of different films for packing in air and MA, and the low initial numbers of Campylobacter on the birds.

The project team suggests that our organisation considers measuring gas mixtures in packs used in future retail chicken surveys. This would provide useful information on the variability of the gas mixtures in retail packs and on possibly the effects of MA on numbers of Campylobacter.

Back to top

Research report

England, Northern Ireland and Wales

PDF
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