

Extension project 1: Appendix2

MO 1019: Physical methods readily adapted to existing commercial lines for reducing pathogens, particularly campylobacters, on raw poultry

Appearance Trial 30-Sep-2004

Report 05.11.2004

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Summary

This report is provided as part of FRPERCs contribution to the FSA project **MO 1019: Physical methods readily adapted to existing commercial lines for reducing pathogens, particularly campylobacters, on raw poultry.**

The aim of this work was to extend the current project to evaluate the efficiency of combinations of decontamination procedures, identified in the laboratory as having the potential to reduce campylobacter on poultry, under commercial conditions. Stage I of the work was the selection of commercial treatment combinations.

To do this, data was required on:

1. Times, temperatures and treatment combinations and effect of these on appearance and other practicalities.
2. Identification of combinations with most potential to reduce campylobacter numbers in when applied on site.

The following method was planned:

1. Transport steam and immersion rigs to commercial plant and commission on site.
2. Carry out preliminary trials with batches of 25 carcasses to check procedure through from treatment to final evaluation
3. Carry out matrix of combination trials with 25 carcasses per trial (Decontamination -3 steam times, 3 immersion times x 3 immersion temperatures; Chilling-decontamination treatment combined with conventional chilling and crust freeze treatment). Near surface and environmental temperatures being monitored during decontamination and chilling
4. Evaluate appearance and other physical factors on whole carcasses and range of poultry products produced from carcasses.
5. Identify commercial treatment combinations for microbial evaluations based on previous laboratory trials and results from 4.
6. Produce report on results and recommendations for microbial evaluation.

Poultry carcasses were subjected to 5 s or 10 s immersion in steam (100°C), or, 10 s or 20 s immersion hot water (80°C). Carcasses were then chilled, portioned and packed as the normal product. Pack appearances were assessed after 5 and 11 days storage at a nominal 1°C. The results showed that while a range of appearances was deemed acceptable. The immersion treatments gave better appearance scores than steam treatments. Some portions (drumsticks, skinless breast) were acceptable for all treatments, and appearance tended to become more acceptable with time.

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Aim

The aim of this work was to extend the current project to evaluate the efficiency of combinations of decontamination procedures, identified in the laboratory as having the potential to reduce campylobacter on poultry, under commercial conditions.

To do this, data was required on:

1. Times, temperatures and treatment combinations and affect of these on appearance and other practicalities.
2. Identification of combinations with most potential to reduce campylobacter numbers in when applied on site.

The aim of the work detailed in this work was to address point 1, Times, temperatures and treatment combinations and affect of these on appearance and other practicalities under commercial conditions. The final appearance of whole carcasses and portions from carcasses that had been treated in the Steam and Immersion experimental rigs were evaluated at a commercial poultry processing plant.

Method

Equipment

Full descriptions of the steam and hot water equipment used can be found in Extension Report 1 and Extension Report 1 Appendix 1.

Treatment protocol

The experimental rigs were set up in the entrance section of the evisceration room close to the carcass entry point into the track chiller (Figure 1).



Figure 1. Atmospheric steam and hot water immersion pilot rigs at the poultry plant.

For each treatment condition, batches of 15-20 carcasses were removed from the line at the 2nd transfer station, and placed together into a wheeled bin. The bin was taken to the experimental area and each carcass tagged on the wing to allow tracking through the chiller. Immediately after tagging, each carcass was treated and placed in a lined crate. Each crate contained 4 carcasses. When treatment had been completed for all carcasses in that treatment group, the crates were taken back to the 2nd transfer point and the carcasses manually rehung on the shackle line for transit through the chiller. After chilling, all carcasses were collected and placed in crates marked with a different coloured liner for each treatment group. The treatments and markings are shown in Table 1

Table 1. Experimental Codes and Group Tracking

Group	Treatment	Tagging	Post Chill Crate Liner
Control	none	none	none
A	Steam 10 s (100°C)	Single black	Red
B	Steam 5 s (100°C)	Single red	Green
C	Immersion 20 s (80°C)	Double black	Yellow
D	Immersion 10 s (80°C)	Double red	Blue

Three carcasses were taken from each group for whole carcass trussing. During a break in production, the remaining 12 carcasses were put through the normal production automatic cut-up equipment to produce wings, drumsticks, thighs and breastcaps for each group. The

breastcaps were then manually cut to produce skin-on and skinless breast fillets. Three final packs of each portion type were produced for each treatment group (Table 2).

Table 2. Final packs

Pack	Product notes	Packaging	Shelf Life
Whole carcass	trussed	Overwrap	8days
Thighs		MAP	10days
Drumsticks		MAP	10days
Breast	skinless	MAP	10days
Skin-On Breast	-	MAP	10days
Wings		MAP	10days

One of each pack type was distributed to the poultry processing company, Sainsbury's and FRPERC for appearance assessment.

Observations

Observations during treatment

Steam

Rapid skin shrinkage was visible (especially on neck flap) during both 5 and 10 s skin treatments. The skin became brittle during the treatment resulting in damage at the thigh/body joints as the carcasses were rehung before the chiller.

Immersion

There was substantial variation in the times required for the water to drain out of the chicken cavity after it had been lifted out of the process tank. There appeared to be no correlation to chicken size. There was less skin embrittlement caused during the immersion treatment giving less rehang damage than with steamed carcasses. After treatment of 30 carcasses there was a noticeable oily film on the water surface in the process tank.

Observations after chilling and during trussing

Group A. Steam 10s

When compared to control carcasses:

- Treated carcasses were easily recognised by a yellowing of skin colour.
- Damage from the pluckers (skin rub) was more visible
- Skin on treated carcasses appeared tauter and shinier.
- Skin had shrunk back exposing keel of breast bone in approx 50% of carcasses

No discolouration of flesh beneath skin was apparent. All 3 carcasses split at vent on trussing

Group B. Steam 5 s

This group exhibited similar traits to group A, but with less intensity. The skin cover over the keel was much improved suggesting skin shrinkage was less. Two of 3 carcasses split at vent on trussing

Group C. Immersion 20 s

These carcasses looked better than most steam treated carcasses, the colour was closer to that of control carcasses but still not identical. The skin was substantially looser and more flexible than steam treated carcasses. All 3 carcasses trussed without skin ripping.

Group D. Immersion 10 s

These carcasses looked very similar to group C. Two of 3 carcasses split at vent on trussing but the looser skin allowed presentation to be recovered.

One of each pack type / treatment combination were collected from Faccenda on day 3 transported to FRPERC and stored at 1°C ±0.5. All packs were visually assessed on days 5 and 11, with whole carcass having additional assessment on day 8. The 5-6 person assessment panels were drawn from FRPERC staff who have recently selected and purchased

packed chicken from supermarkets. Assessments were made on a 3 point visual appearance scale:

A – Acceptable

B – Borderline

C – Un-acceptable

On days 5 and 11, all packs were laid out and each panel member was individually asked to rank each pack on the 3 point visual appearance scale. Treatments given were not made known to the panel. Additional comments made on individual packs are given in Appendix A.

The combined visual results are shown in Table 3 and Table 4

Table 3. Day 5 Appearance Scores

Pack	Treatment				
	Red Steam 10 s (100°C)	Green Steam 5 s (100°C)	Yellow Immersion 20 s (80°C)	Blue Immersion 10 s (80°C)	White Control
Whole Carcass	2A, 3B, 1C	1A, 3B, 2C	1A, 2B, 3C	2A, 2B, 2C	6A, 0B, 0C
Thigh	1A, 3B, 2C	1A, 4B, 1C	1A, 3B, 2C	3A, 2B, 1C	5A, 1B, 0C
Drumstick	5A, 1B, 0C	4A, 1B, 1C	5A, 1B, 0C	5A, 1B, 0C	6A, 0B, 0C
Breast	1A, 3B, 2C	1A, 4B, 1C	3A, 2B, 1C	3A, 2B, 1C	5A, 0B, 1C
Skinless Breast	5A, 1B, 0C	3A, 2B, 1C	5A, 1B, 0C	6A, 0B, 0C	5A, 1B, 0C
Wing	1A, 3B, 2C	1A, 3B, 2C	0A, 2B, 4C	4A, 2B, 0C	3A, 3B, 0C

Table 4. Day 11 Appearance Scores

Pack	Treatment				
	Red Steam 10 s (100°C)	Green Steam 5 s (100°C)	Yellow Immersion 20 s (80°C)	Blue Immersion 10 s (80°C)	White Control
Whole Carcass	0A, 5B, 0C	0A, 5B, 0C	2A, 3B, 0C	3A, 2B, 0C	5A, 0B, 0C
Thigh	1A, 1B, 3C	2A, 1B, 2C	2A, 1B, 2C	2A, 2B, 1C	3A, 2B, 0C
Drumstick	4A, 1B, 0C	4A, 1B, 0C	5A, 0B, 0C	4A, 1B, 0C	5A, 0B, 0C
Breast	1A, 4B, 0C	2A, 0B, 3C	3A, 2B, 0C	3A, 2B, 0C	3A, 2B, 0C
Skinless Breast	4A, 1B, 0C	4A, 1B, 0C	5A, 0B, 0C	3A, 2B, 0C	4A, 1B, 0C
Wing	0A, 3B, 2C	2A, 2B, 1C	1A, 3B, 1C	2A, 2B, 1C	5A, 0B, 0C

Borderline scores were then ascribed to the most common definite opinion score to give a single combined panel score for each pack (Table 5).

Table 5. Overall Pack Appearance

Pack	Day	Treatment				
		Red Steam 10 s (100°C)	Green Steam 5 s (100°C)	Yellow Immersion 20 s (80°C)	Blue Immersion 10 s (80°C)	White Control
Whole Carcass	5	A	C	C	B	A
	11	B	B	A	A	A
Thigh	5	C	B	C	A	A
	11	C	B	B	A	A
Drumstick	5	A	A	A	A	A
	11	A	A	A	A	A
Breast	5	C	B	A	A	A
	11	A	C	A	A	A
Skinless Breast	5	A	A	A	A	A
	11	A	A	A	A	A
Wing	5	C	C	C	A	A
	11	C	A	B	A	A

On each day the panel was asked to indicate which treatment group was overall the most acceptable (Table 6)

Table 6. Most acceptable treatment considering all packs

Day	Treatment				
	Red Steam 10 s (100°C)	Green Steam 5 s (100°C)	Yellow Immersion 20 s (80°C)	Blue Immersion 10 s (80°C)	White Control
5				1	5
11			2		3

On day 8, only the treated whole carcasses were laid out and the 3 point assessment made. Then the control carcasses were added and the panel asked to re-assess the packs.

Control presence	Treatment			
	Red Steam 10s (100°C)	Green Steam 5s (100°C)	Yellow Immersion 20s (80°C)	Blue Immersion 10s (80°C)
none	2A, 1B, 2C	1A, 2B, 2C	3A, 1B, 1C	1A, 4B, 0C
with control	2A, 1B, 2C	1A, 2B, 2C	2A, 2B, 1C	1A, 4B, 0C

Photos of the samples after 11 days storage can be found in Appendix B.

Retailer Evaluation

Following on from the trial carried out at the poultry processing company on 30th September, where the carcasses treated with steam or hot water, the chilled carcasses were chilled through the inline chiller and then portioned and the resulting portions packed retail style. These portions were held in the despatch at the poultry processing company and then sent to a leading supermarket chain for review. On Tuesday 5th October a representative of the poultry processing company went to the supermarket headquarters to look at the portions with the food technologist concerned.

These were the comments made:

Steam for 10 s

“The whole carcasses were very pink by comparison to the control and the skin had split over the tip of the keel during trussing. The barking on the skin had disappeared under the film of the tray wrapped pack. The skin of the skin on the portions looked wrinkled and a little pinker.”

Steam for 5 s

“The comments for the Steam 10 seconds were pretty much the same for the steam 5 seconds but the whole carcass had not ripped.”

Hot Water 20 s

“The whole carcass skin was only slightly discoloured, it had rehydrated and looked wrinkled. The portion skin had a better appearance than the steam treated carcasses but it was still wrinkled compared to the control. On the skinless fillets there was some scalding present.”

Hot Water 10 s

“The whole carcass skin colour was very similar to the control. The portions were similar to the control but there was some wrinkling obvious on the thighs and drumsticks.”

Overall

“It was the opinion of the supermarket food technologist that none of the processes were equal in appearance to the control and without similar appearance on the shelf it would be a non-starter. His suggestion was whether the 10 sec hot water treatment could have some other form of intervention to improve the appearance; his thought was whether plunging them into cold water after the hot would reduce the skin wrinkling.

As far as the processes used, none give them what they want but they do like the idea of a 2 log reduction in micro. I know that no micro work had been done on 10-second hot water but that was the only one they found close to acceptable. Without any micro work it is not clear whether there would be a significant log reduction in counts.”

Discussion

For most packs, the panel were not in total agreement. No packs were unanimously unacceptable, but several packs were unanimously acceptable (Control Whole carcass and Drumsticks on both days, 20 s Immersion drumsticks and skinless breast on day 11, and Control wings on day 11). 42% of packs had both acceptable and unacceptable scores from different panellists. This suggests that individuals' opinions influence choice more than the range of pack appearances seen in these trials. A comment from one panellist was "I have seen a similar range of (pack) appearances on the supermarket shelves".

On day 5, 63% packs were scored acceptable, 10% borderline and 27% unacceptable. Only the packs from the untreated control carcasses were all scored acceptable. However, the 10 s immersion treatment scored highly with all packs being acceptable and the whole carcass borderline.

On day 11, 73% of packs were scored acceptable, 17% borderline and 10% unacceptable. All packs from both the untreated control carcasses and the 10 s immersion treatment were scored acceptable. No packs from the 20 s immersion treatment were scored unacceptable.

Nine packs improved their scores from day 5 to day 11, only 1 pack dropped appearance score in that period.

All treatments produced acceptable drumsticks and skinless breasts on both days.

Overall from the panel results a wide range of appearances were acceptable.

- Some portions (drumsticks, skinless breast) were acceptable for all treatments.
- Immersion treatments gave better appearance scores than steam treatments.
- Appearances tended to become more acceptable with time.

The supermarket view appears to be that any change is unacceptable. However, it is not clear if the samples were blind tested or just the opinion requested. It is positive that they are suggesting looking at adding a rapid cooling possibly using water and this should be followed up.

Appendix A. Combined Panellists Comments

Pack	Day	Treatment				
		Red Steam 10s (100°C)	Green Steam 5s (100°C)	Yellow Immersion 20s (80°C)	Blue Immersion 10s (80°C)	White Control
General	5					
General	11	Yellower tinge	Yellower tinge	Not bad	Thin skin	
Whole Carcass	5	Torn skin	Torn skin (2)	Yellow tinge Legs wrinkly	Veins	Very good
Whole Carcass	11	Torn skin (3)	Torn skin (3)	Floppy		
Thigh	5	Yellow Dry Dark	Loose skin Dark	Loose skin	Loose skin Wrinkly skin	
Thigh	11	Dry Yellow Dark skin	Loose skin	Loose skin	Loose skin Wrinkly skin	
Drumstick	5				Loose skin Wrinkly skin	Very good
Drumstick	11	Dark skin			Wrinkly	
Breast	5	Torn skin	Loose skin Torn skin	Loose skin	Loose skin Wrinkly skin	
Breast	11	Ripped skin Dark skin	Ripped Floppy Dark	Wrinkly	Slight wrinkles in skin	Slimy look Wet and slimy look
Skinless Breast	5					
Skinless Breast	11	Lost gloss Look tired	Lost gloss Look tired	Lost gloss Look tired	Lost gloss Look tired	Lost gloss Look tired
Wing	5	Yellow Dry look Dark	Torn skin Dark Skin	Blood Dry looking skin		
Wing	11	Bit yellow Shrivelled	Ripped skin	Bit dry looking Blood	Bit dry looking	

(n) number of panellists making similar comments

Appendix B. Photos of samples after 11 days storage

All photo's - Treatments Left to Right: Control, Steam 10 s (100°C), Steam 5 s (100°C),
Immersion 20 s (80°C), Immersion 10 s (80°C)



Figure 2. Drumsticks



Figure 3. Wing portions



Figure 4. Skinless breast portions



Figure 5. Skin on breast portions



Figure 6. Skin-on thigh portions



Figure 7. Whole trussed carcasses

Insurance requirements

The work associated with this contract / grant has been carried out in accordance with the highest academic standards and reasonable endeavours has been made to achieve the degree of reliability and accuracy appropriate to work of this kind.

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