

MH0 138: Reducing stress and discomfort on the poultry shackle line

Appendix 2

Full assessment of the functionality and welfare aspects of the breast support conveyor, including entry into the stun bath

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AIM: To test the functionality of the prototype conveyor system and compare it's effectiveness with the existing system in moving live birds at 3 critical points in the handling system:

Critical point 1.	At shackling (hang-on)
Critical point 2.	Travelling to the stun bath
Critical point 3.	On entry to the stun bath

Systems were assessed via the behaviour of the birds at the 3 critical points. Data on the weight and shank circumference of the birds was recorded to investigate the correlation of behaviour with bird size, and the incidence of red wingtips was recorded to assess the effectiveness of the entry to the stun.

METHODS:

Systems and birds:

Assessments on the effectiveness of the prototype conveyor (CON) and the existing (unmodified) breast-rub strip (BS) were conducted on two separate occasions, as it was impossible to alter between the two systems during the course of the working day.

Six flocks were assessed over 2 days (28/29 October 2008) for the CON system and 5 flocks were assessed over a further 2 days (11/12 November 2008) for the BS system. Birds were from free range and organic farms that regularly supplied the processor. Flocks from 5 farms were observed through both the CON and BS systems. The layout of the processing line is described in Figure 5 of the main report.

Behavioural observation:

i. Direct observation: For critical points 1 and 2, every 25th shackle on the line was numbered (1-14) and all birds placed within the numbered shackles or immediately to the right of an empty

numbered shackle, were observed by operative 1. The number, bout length and location of each struggling bout exhibited by the observed bird were recorded, and the percent incidence of struggling bouts by location on the line, and average struggling bout length (sec) calculated. Struggling was defined by vigorous body movements and wing flapping. The position of the birds on the CON were also recorded as 'correct', where the breast was fully supported by the conveyor, or 'incorrect' where the bird was supported by the neck/crop on the conveyor. Finally, vocalisation by the bird was also recorded (absent/present).

For critical point 3, the entry to the stun bath was recorded by operative 2, as good, intermediate or poor, defined below. The percent incidence of good, intermediate and poor entries were then calculated and presented according to the main cause of the unclean entry.

- Good entry:** Bird's head falls straight into water bath, so that the bird is stunned rapidly with no struggle
- Intermediate entry:** The bird struggles, lifts up in the shackles, or flaps its wings, so that it does not enter the stun bath cleanly. The bird enters the bath within 20cm of the entrance.
- Poor entry:** The bird struggles, lifts up in the shackles, or flaps its wings (wing touches water first), and so it does not enter the stun bath cleanly or quickly. The bird enters the bath beyond 20cm of the entrance.

ii. Indirect observation: Three CCTV cameras, linked to VCRs, were installed on the processing line. Camera 1 recorded the hang-on area and short straight to the 90° corner. Camera 2 recorded the corner, and camera 3 recorded the straight to the stun bath (this section was partially enclosed in the CON system). For critical points 1, 2, and 3, every 4th bird was observed for the incidence of struggling, and the percent incidence of struggling by location calculated.

Incidence of red wingtips, weight and shank circumference:

On exit of the scald tank, every 5th bird and all numbered birds were recorded for body weight, shank circumference and the incidence of red wingtips and blood in the joints, by operatives 3 and 4. The right shank was measured in-situ below the point of the spur bud (mm) and a note was made of any grazing or damage to the skin of both shanks. The bird was then briefly removed from the processing line and weighed (non branded digital scales accurate to 2g). It was re-hung and the incidence and severity of red wingtips and blood in the joints recorded by wing (right, left) and position on wing; percent incidences were then calculated. Missing joints, bruises and (non mechanical) dislocations were also noted. Wing position was:

- Position 1, wingtips = digit III at the leading edge of the wing
- Position 2 = carpometacarpus / ulna joint (wrist)
- Position 3 = ulna, radius / humerus joint (elbow)
- Position 4 = humerus / clavical joint (shoulder)

The severity was recorded as follows:

- Mild: <5mm of blood in the wingtip or joint
- Moderate: 5-10mm of blood in wingtip or joint
- Severe: >10mm of blood in the wingtip or joint

Statistical Analysis:

The statistical unit of replication was the flock. Data were analysed by Analysis of Variance (ANOVA) with the fixed effect of treatment (CON or BS). Mean values and the range (minimum to maximum) are presented, along with the F ratio for the test and the actual p value. In the tables, (n) gives the total number of birds observed and the degrees of freedom (DF) indicate the number of flocks tested (number of flocks -1). Not all flocks provided data under all circumstances and reasons for missing data are given in the text. A Pearson's Correlation Test was used to investigate the relationship between behaviour and bird size.

RESULTS

1. Percent of birds struggling and the length of struggling bouts (direct observation)

- A higher % of birds DID NOT struggle with CON than BS
- A higher % birds struggled at hang on with BS

Percent of birds struggling on the line according to location

Event	With Conveyor (n=150)	With breast strip (n=132)	Significance level DF (1,9)
No struggling events %	85.3 (66.7-100)	57.6 (43.8-69.8)	F=13.0 p=0.007
Struggle at hang-on %	1.4 (0-6.7)	11.4 (3.8-25.0)	F=5.8 p=0.043
Struggle on the straight %	2.5 (0-13.3)	3.7 (0-12.5)	NS
Struggle round the corner %	8.6 (0-26.7)	13.6 (5.7-23.9)	NS
Struggle in the enclosed section %	4.4 (0-16.7)	10.7 (0-25.0)	NS
Struggle on the ramp to stun %	NR	8.1 (0-12.5)	-
% Birds wrongly positioned	9.5 (0-20.0)	N/a	

(minimum-maximum) NR (No ramp)

- There were no significant differences in % birds struggling on the straight, corner or enclosed section
- 9.5% of birds were considered to ride the conveyor incorrectly
- One flock in (BS) did not contribute data to this section, as few birds were processed and only 1 or 2 birds were directly observed.

Length of struggling bouts according to location

Struggling bout length (sec)	With Conveyor	With breast strip	Significance level DF (1,9)
At hang-on	0.7 (0-2)	2.1 (1-3)	F=4.9 p=0.058
On the straight	0.9(0-3.5)	0.9 (0-2)	NS
Round the corner	2.0 (0-5)	1.7 (1.2-2)	NS
In the enclosed section	0.9 (0-2)	1.1 (0-2.3)	NS
Ramp to stun	NR	1.1 (0-2.3)	

(minimum-maximum), NR (no ramp)

- The average time per struggling bout was greater at hang-on for BS than CON (trend)
- In general struggling bouts were of short duration
- On average 2.2 and 9.0% of birds exhibited two struggling bouts for CON and BS respectively (p>0.05) and 4.8 (CON) and 0.5% (BS) exhibited three struggling bouts (p>0.05)
- On average 40.9 and 50.6% birds vocalised (p>0.05) whilst moving along the CON and BS respectively

2. The percent of birds struggling at camera positions 1, 2, and 3

Hang-on to corner (camera 1)

Event	With Conveyor (n=291)	With breast strip (n=399)	Significance level DF (1,7)
Total struggling events %	10.5 (4.6-22.2)	7.3 (0-13.3)	NS
Struggle at hang-on %	4.6 (0-11.1)	1.6 (0-7.1)	NS
Struggle on the straight %	0.2 (0-0.5)	2.6 (0-6.7)	NS
Struggle round the corner %	5.7 (1.6-11.1)	3.1 (0-6.7)	NS
Wrong position on conveyor %	25.8 (10.2-44.4)	N/a	

(minimum-maximum)

- There was no difference in the % birds struggling from hang-on to the corner
- Two flocks (CON) did not contribute data to this data due to equipment failure

Coming out of the corner (camera 2)

Event	With Conveyor (n=569)	With breast strip (n=884)	Significance level DF (1,7)
Struggle out of corner to enclosed section %	33.5 (26.2-40.0)	11.5 (1.9-17.1)	F=23.3 p=0.003
Wrong position %	14.2 (11.0-16.7)	N/a	

- A higher % of birds struggled as they moved out of the corner with CON than BS
- 14.2% of birds on CON were considered wrongly positioned at this point
- Two flocks (CON) did not contribute data to this data due to equipment failure

Along the straight to the stun bath (camera 3)

Event	With Conveyor (n=374)	With breast strip (n=775)	Significance level DF (1,10)
No struggle	69.6 (47.7-97.5)	91.9 (86.2-100)	F=6.9 p=0.028
1 struggling event	26.1 (2.5-48.9)	7.7 (0-13.7)	F=5.4 p=0.045
2 struggling events	4.0 (0-7.8)	0.4 (0-1.4)	F=8.3 p=0.018
3 struggling events	0.3 (0-0.8)	0	NS

(minimum-maximum)

- A higher % of birds DID NOT struggle with BS than CON
- Most birds exhibited a single struggling event, and a higher % of birds exhibited two events with CON than BS

3. Bird entry to the stun bath (direct observation)

Percent of birds with good, intermediate and poor entries to the stun bath

Entry	With conveyor (n=2857)	With breast strip (n=2491)	Significance DF (1,10)
Good	54.7 (28.8-80.1)	13.2 (4.5-30.1)	F=15.6 p=0.003
Intermediate	38.6 (17.9-56.5)	50.6 (40.0-58.7)	NS
Poor	6.7 (1.2-15.0)	36.2 (20.2-47.0)	F=29.6 p=0.000

(minimum-maximum)

- A higher % of birds entered the stun bath cleanly (good) with the CON than the BS
- There was no difference in the % of intermediate entries
- A higher % of birds entered the stun bath poorly with the BS than the CON

Intermediate and poor entries by problem (% incidence)

Entry problem: INTERMEDIATE	With conveyor	With breast strip	Significance
1 leg	5.3	0.04	F=13.2 p=0.005
Struggle	79.8	0.5	F=296 p=0.000
Lift up	6.8	0.3	F=13.0 p=0.006
Wing flap	8.1	99.1	F=1899 p=0.000

(minimum-maximum)

Entry problem: POOR	With conveyor	With breast strip	Significance
1 leg	33.9	0.3	F=17.4 p=0.002
Struggle	40.2	0.6	F=20.0 p=0.002
Lift up	10.8	2.8	NS
Wing flap	15.8	96.3	F=337 p=0.000

(minimum-maximum)

- The causes of intermediate and poor entries to the stun bath were significantly different between the systems.
- For the CON, intermediate and poor entries were largely due to birds struggling on the conveyor prior to entry to the stun bath, or lifting up out of the shackle or being shackled by one leg only.
- For the BS, intermediate and poor entries were almost entirely due to the leading wing touching the water first causing the bird to struggle in the shackle.

4. Shank circumference, weight, redwing tips

Shank circumference and incidence of grazing, and weight of birds

	With conveyor (n=564)	With breast strip (n=536)	Significance level DF (1,10)
Shank circumference (cm)	4.8 (4.6-4.9)	4.7 (4.4-5.0)	NS
% incidence of grazed shank (left)	85.4 (80.3-90.5)	81.3 (68.6-91.0)	NS
% incidence of grazed shank (right)	82.3 (76.3-89.7)	87.7 (81.4-100)	NS
Weight	2305 (2062-2632)	2254 (1691-2593)	NS

(minimum-maximum)

Percent incidence of red wing tips (position 1) and blood in the wing joints (positions 2-4)

0 = No incidence of red wingtips or blood in the joints

	System	Right wing: lead wing				Left wing			
		1	2	3	4	1	2	3	4
0	Conveyor	10.7	89.5	98.2	99.4	3.1	79.0	96.8	98.5
	Breast strip	0.4	57.3	98.3	94.3	0.1	55.2	97.4	99.1
	Significance	F=17.2 P=0.003	F=9.6 P=0.015	NS	NS	F=13.6 P=0.006	F=5.6 P=0.047	NS	NS

(minimum-maximum)

- A lower % of birds had blood free wingtips and second joint (both wings) in the BS than CON

- There was no difference between system for the third and fourth joints, which were largely clear of blood

1 = Mild incidence of red tips and blood in joints

	System	Right wing: lead wing				Left wing			
		1	2	3	4	1	2	3	4
1	Conveyor	72.9	7.8	1.5	0.7	78.8	15.8	3.2	1.3
	Breast strip	72.8	33.4	1.3	0.1	56.7	33.4	2.2	0.1
	Significance	NS	F=10.4 p=0.012	NS	NS	F=5.3 p=0.051	F=6.0 P=0.039	NS	NS

(minimum-maximum)

- A higher % of birds with mild redwing tips in the left wing with CON than BS
- A higher % of birds with mild levels of blood in joint 2 (both wings), with BS than CON

2 = Moderate red tips or blood in the joint

	System	Right wing: lead wing				Left wing			
		1	2	3	4	1	2	3	4
2	Conveyor	10	1.3	0	0	13.9	2.9	0.2	0.3
	Breast strip	23.0	7.1	0.2	0	35.6	8.4	0.2	0.1
	Significance	NS	NS	NS	NS	F=5.8 p=0.043	NS	NS	NS

- Higher % of moderate red tips in the left wing with BS than CON

3 = Severe red tips and blood in joints

	System	Right wing – lead wing				Left wing			
		1	2	3	4	1	2	3	4
3	Conveyor	2.5	1.0	0.4	0	2.2	1.7	0	0.2
	Breast strip	3.4	1.0	0.1	0	5.9	2.4	0	0
	Significance	NS	NS	NS	NS	NS	NS	NS	NS

- There was no difference between systems in the levels of severe red wingtips and joints

5. Correlations between variables for individual birds assessed

With Conveyor: Birds vocalised more when they were positioned on the conveyor wrongly ($r=0.21$ $p=0.014$) and were struggling ($r=0.25$ $p=0.003$). Shanks were grazed more with wider shanks (cm) ($r=0.2$ $p=0.015$). Shank circumference and bird weight were positively correlated ($r=0.64$ $p=0.000$).

With breast strip: Shank circumference and bird weight were positively correlated ($r=0.71$ $p=0.000$).

There was no effect of bird weight or shank circumference on any of the measures with significant treatment effects.

SUMMARY

The prototype CON system demonstrated that it was at least AS effective at moving birds from shackling to stun as the existing BS system. There was evidence to suggest that CON performed better than BS at hang-on and on entry to the stun bath. Corners however were less effective with CON than BS. Correct positioning of the bird on the CON was considered important, and this was seen to vary with handler and size of bird in relation to the height of CON.

Critical point 1: Shackling

Birds struggled more during shackling (at hang-on) with BS than CON (direct observation)

Critical point 2: Travelling to the stun bath

Birds travelled the BS and CON systems equally well to the corner (camera 1)

Birds struggled more coming out of the corner with CON (camera 2)

Birds struggled more on the straight section to the stun bath with CON (camera 3)

Critical point 3. Entry to the stun bath

Birds entered the stun bath more cleanly after the CON than BS system

Poor entries were high with BS and were primarily due to birds wing flapping as they came off the ramp

In consequence, there was a higher incidence of red wingtips and blood in the first joint (wrist) of birds on the BS system