Project Title: A Comparison of Residual GFAP Levels on the Blade, in the Nose Wheel Housing, and in the Drive Wheel Housing of the Jarvis Buster IX and Buster IV Carcass Splitting Saws Before and After Dipping

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Background

In September of 2004, Helps et al. (2004) indicated that a common, commercial beef carcass splitting saw (Jarvis Buster VI, Middletown, CN) provides potential for cross-contamination of beef carcasses with potentially infectious tissue. They determined that debris (CNS tissue) remains inside saws despite attempts to sanitize them between splitting differing carcasses during operation. Consumption of CNS tissue infected with Bovine Spongiform Encephalopathy (BSE) has been linked with variant Creutzfeldt-Jakob Disease (vCJD) in humans (Williams, 1997). Additionally, the USDA Food Safety and Inspection Service (FSIS), in an Interim Final Rule issued January 12, 2004, designated the tonsils and the small intestine from all cattle, spinal cord, brain, trigeminal ganglia, eyes, skull, and dorsal root ganglia (from cattle >30 months of age) as Specified Risk Materials (SRM) and prohibited them from entering the human food chain. Cross-contamination with CNS tissue via the splitting saw without further process interventions could result in a food safety threat. Immunochemical methods to detect presence of CNS tissue in or on meat products have been developed (Schmidt et al., 1999, 2001; Hossner et al., 2004). The favored method uses a fluorometric enzyme-linked immunosorbent assay (f-ELISA) for the detection of glial fibrillary acidic protein (GFAP). Glial fibrillary acidic protein is the major protein constituent of glial filaments in differentiated astrocytes which are restricted to the CNS (Eng and Lee, 1995). The efficacy of the GFAP f-ELISA was examined for detection of CNS tissue in blood and muscle from beef cattle (Schmidt et al., 1999, 2001); the GFAP f-ELISA proved to be a simple, cost effective, safe and efficient method to detect minute quantities of CNS tissue in non-neural tissues of beef.

The objective of this study was to compare residual GFAP levels on the blade and in the housings of the Jarvis Buster IX and Buster IV saws.

Methodology

Buster IX vs. Buster IV Comparison

The Jarvis Buster IX and Buster IV saws are commercially available carcass splitting saws. The Buster IX is the saw most commonly used in packing plants in Europe, whereas the Buster IV is commonly used in American packing facilities. The Buster IX is a larger saw with a longer blade length (127 inches vs. 119 inches in the Buster IV), but it runs at the same revolutions per minute (RPMs) as the Buster IV. The reason for conducting this comparison is that the Buster IX is a newer model saw with a more advanced internal washing system. The Buster IX has an internal sanitizing system for both the nose wheel and drive wheel housings and for the blade guides. Saw washing in Buster IX saw involves 2 stages. The first is a continuous water flushing system that operates while the saw is splitting a carcass. The second stage is a flush of the nose wheel and drive wheel housings every time the blades are stopped. The Buster IV model does have the continuous flushing system

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during splitting, but it does not have the flush of the housings when the saw becomes idle. This study was conducted to determine if this newer, more advanced, internal washing system in the Buster IX is more effective at reducing GFAP on the blade, in the drive wheel housing, and in the nose wheel housing.

Swab samples were collected from Jarvis Buster IX and Buster IV carcass splitting saws during operation at a commercial beef packing facility. Split saw operators performed the normal saw washing practices between sampling periods. When samples were to be collected from the carcass splitting saws, saw operators were instructed not to dip their saws so that "before" samples could be taken from each saw. Once before samples were collected from the three sampling sites, the saw operator dipped the saw into the 180 ° F dipping vat for 1-2 seconds; then after samples were collected. The three sampling sites on each saw were the exposed surface of the blade, the nose wheel, and the drive wheel. To collect samples from the blade of the saw, one side of the exposed surface of the blade was swabbed. Drive wheel samples were collected by swabbing from the drain at the bottom of the housing to the top of the curvature of the wall of the housing. Nose wheel samples were collected by swabbing the curved part of the nose wheel housing. Sampling was accomplished by making 10 horizontal and 10 vertical passes with one cotton swab per sampling site. (One pass is considered to be one up and down or one side to side motion with the swab.) After each set of before and after samples was collected from both saws, each saw split approximately 50 carcasses before another sample was obtained. All samples were collected over the course of one production shift. Each sample was immediately placed into an individual 12 X 75 polypropylene tube and capped. All samples were frozen overnight and analyzed using the GFAP f-ELISA protocol outlined in Schmidt et al. (2001) with the following modifications: samples were agitated in an up/down motion 10-15 times in the sample buffer and, a 320 nm excitation filter was used instead of a 360 nm filter to read plates, as it was found to be more appropriate for this assay.

Findings

Both the Jarvis Buster IX and Buster IV carcass splitting saws harbor CNS tissue on the blade. The number of GFAP f-ELISA positive samples on the blade of both the Buster IX and Buster IV saws before and after dipping the saw in a 180 ° F dipping vat for 1-2 seconds is presented in Table 1. A small reduction in GFAP f-ELISA positive samples was found in the Buster IX saw after dipping; while an increase in the incidence of positives was found on the Buster IV saw (Table 1). A chi square test comparing incidence of GFAP positive samples on the blade before and after dipping indicated no difference between the Buster IX and Buster IV saws (> 0.05). The Buster IX was more effective at reducing GFAP on the saw blade when compared to the Buster IV, however, neither saw achieved a statistically significant reduction in GFAP levels (Table 2). Additionally, no statistical difference (<0.05) was found between the levels of GFAP remaining on each saw blade after dipping (Table 2).

The drive wheel housings of the Buster IX and Buster IV saws were extensively contaminated with CNS tissue. An increase in the number of GFAP f-ELISA positive samples in the drive wheel housing in the Buster IX after dipping in 180 ° F water and no change in the incidence of GFAP positive samples in the Buster IV saw is illustrated in Table 3. A chi square test comparing incidence of GFAP positive samples in the drive wheel housing before and after dipping indicated no statistical differences on the Buster IX or Buster IV saws (> 0.05) (Table 3). A statistically significant reduction (> 0.05) in GFAP concentration in the drive wheel housings of the Buster IX and IV saws after dipping was not found. However, the levels of GFAP present in the drive wheel housing of the Buster IV saw after dipping was statistically lower than the GFAP levels in the drive wheel housing of the Buster IX after dipping (< 0.05).

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The nose wheel housings of the Buster IX and Buster IV saws are also contaminated with CNS tissue. Both saws showed a slight increase in samples testing positive for GFAP in the nose wheel housing after dipping (Table 5). A chi square test comparing incidence of GFAP positive samples in the drive wheel housing before and after dipping indicated no statistical differences (> 0.05) on both the Buster IX and Buster IV saws (Table 4). The Buster IX showed a decrease in GFAP concentration in the nose wheel housing; whereas, the Buster IV showed a slight increase (Table 6). No statistical difference (> 0.05) was found between the levels of GFAP remaining in each nose wheel housing after dipping (Table 2).

Implications

Use of the Buster IX resulted in both a lower count of GFAP f-ELISA positive samples and a lower amount of GFAP material remaining on the blade after dipping in a 180 ° F dipping vat for 1-2 seconds. The Buster IX had less residual GFAP in the nose wheel housing but an equal number of GFAP positive samples. However, the Buster IX had a greater amount of residual GFAP material in the drive wheel housing than the Buster IV. Results of this study suggest that the Buster IX may be more effective a reducing the amount of residual GFAP present in the saw than the Buster IV.

Table 1. Number (%) of samples from Jarvis Buster IX and Buster IV carcass splitting saws that had detectable levels of GFAP on the blade before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value
Buster IX	16 (48.5%)	14 (42.4%)	0.621
Buster IV	15 (45.5%)	22 (66.7%)	0.083

Table 2. Mean (ng/100cm^2) GFAP levels on the blade of the Buster IX and Buster IV carcass splitting saws before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value (Before vs. After Saw Dipping)	P-Value Buster IX vs. Buster IV After Saw Dipping
Buster IX	15.52 ± 4.39	6.71 ± 2.28	0.223	0.256
Buster IV	11.28 ± 3.56	10.47 ± 2.28	0.225	

Table 3. Number (%) of samples from Jarvis Buster IX and Buster IV carcass splitting saws that had detectable levels of GFAP in the drive wheel housing before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value
Buster IX	29 (87.9%)	31 (93.9%)	0.392
Buster IV	32 (97.0%)	32 (97.0%)	1.000

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Table 4. Mean (ng/100cm^2) GFAP levels in the drive wheel housing of the Buster IX and Buster IV carcass splitting saws before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value (Before vs. After Saw Dipping)	P-Value Buster IX vs. Buster IV After Saw Dipping
Buster IX	24.97 ± 4.32	23.80 ± 4.32	0.847	< 0.0001
Buster IV	11.23 ± 1.68	10.60 ± 1.68	0.792	

Table 5. Number (%) of samples from Jarvis Buster IX and Buster IV carcass splitting saws that had detectable levels of GFAP in the nose wheel housing before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value
Buster IX	30 (90.9%)	31 (93.9%)	0.642
Buster IV	30 (90.9%)	31 (93.9%)	0.642

Table 6. Mean (ng/100cm^2) GFAP levels in the nose wheel housing of the Buster IX and Buster IV carcass splitting saws before and after dipping the saw in 180°F water following carcass splitting.

Saw	Before Dipping (n=33)	After Dipping (n=33)	P-Value (Before vs. After Saw Dipping)	P-Value Buster IX vs. Buster IV After Saw Dipping
Buster IX	17.86 ± 2.68	12.70 ± 2.60	0.177	0.215
Buster IV	13.50 ± 2.46	14.05 ± 2.39	0.874	

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