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Stunning Method and Time Interval  
from Stunning to Bleeding Effects  
on Blood Splashing in Pork

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### Summary

Two studies were designed to test the effects of stunning method and time interval between stunning and bleeding on blood splashing in pork muscle. In study I, 82 market weight barrows and gilts were randomly assigned to one of two treatments using captive bolt stunning with either a short (18.5 sec) or a delayed (144.7 sec) time interval to bleeding. More ( $P < .05$ ) blood splashing occurred in the ham, loin and shoulder of the delayed time group than in the short time group. In study II, 48 barrows and gilts were randomly assigned to one of four treatment combinations using either captive bolt or electric stunning with either a short (8.7 sec) or delayed (96.0 sec) time interval before bleeding. Carcasses in the captive bolt-delayed time group had more ( $P < .05$ ) blood splashing in the diaphragm, fresh ham face and cured ham than in those muscles from the other treatment groups. Blood splashing in the diaphragm, ham face and cured ham were similar ( $P > .05$ ) for the captive bolt-short, electric-short and electric-delayed time groups.

### Introduction

Blood splashing is an important quality factor in pork especially for small meat processors. Blood splashing is the occurrence of pinpoint size hemorrhages that result when small capillaries in muscle rupture because of increased blood pressure and muscular contraction. The purpose of this study was to observe the combined effects of stunning method and the time interval between stunning and bleeding on blood splashing in pork.

### Procedures

Study I. Eighty-two market weight barrows and gilts were assigned randomly to one of two treatments using captive bolt stunning in combination with either a short (18.5 sec) or delayed (144.7 sec) time interval to bleeding. Pigs in the short time group were stuck and bled on the floor before shackling and pigs in the delayed time group were shackled and hoisted before bleeding. The degree of blood splashing was scored (1=none or practically none, 2=slight, 3=moderate, 4=severe) in the muscles of the wholesale shoulder, loin and ham when the carcasses were fabricated at 48-72 hr postmortem.

Study II. Forty-eight barrows and gilts were assigned randomly to one of four treatments involving all combinations of captive bolt or electrical stunning with either a short (8.7 sec) or delayed (96 sec) time interval to bleeding. Captive bolt stunning was done with a Supercash Mark 2 captive bolt pistol using a two grain charge. Electrical stunning was with a Cervin electrical stunner at a setting of 560 V. After stunning, pigs were stuck and bled on the floor before shackling by the right hind leg. Carcass data and diaphragm blood splashing scores were collected after chilling for 24 hr at 35 F. The number of blood splashes in both the right and left fresh ham face was counted when the carcasses were fabricated. Blood splashes were counted again after the boneless hams were cured and cut into halves.

### Results and Discussion

Study I. Barrows and gilts did not differ ( $P > .05$ ) in the amount of blood splashing in the ham (table 1). Blood splashing scores (table 2) for the ham, loin and shoulder muscles of pigs from the delayed time group were greater ( $P < .05$ ) than those for pigs in the short time group.

Study II. Hot carcass weight (156 lbs), dressing percentage (72.5%), tenth rib fat depth (0.8 in), loineye area (4.7 in<sup>2</sup>) and percentage muscle (55.5%) were not affected by treatment ( $P > .05$ ).

The number of blood splashes in the ham face (table 1) of barrows and gilts were not different ( $P > .05$ ), which agrees with results of study I. Also, there were no differences ( $P > .05$ ) for blood splashing in right or left sides of the carcass (table 1) even though all pigs were shackled by the right leg. Pigs from the captive bolt-delayed time group had more ( $P < .05$ ) blood splashes in the fresh ham face and cured ham and had higher ( $P < .05$ ) blood splashing scores for the diaphragm (table 3) than did pigs in the other three treatments. Data from both studies indicate more blood splashing will occur with extended time intervals from stunning to bleeding when pigs are immobilized using a captive bolt. However, an increased time interval from stunning to bleeding did not affect ( $P > .05$ ) the amount of blood splashing in the ham of electrically stunned pigs.

Pigs in the captive bolt-delayed time group did have more ( $P < .05$ ) blood splashing (table 3) in the ham and diaphragm muscles than did those stunned electrically. However, the number of blood splashes in the ham face and cured ham as well as blood splashing scores for the diaphragm were similar ( $P > .05$ ) for captive bolt-short time and electrically stunned pigs (short and delayed).

Blood splashing occurred more frequently in the muscles of the ham face than in the loin eye or shoulder blade face muscles. Blood splashing in the diaphragm was strongly correlated ( $P < .0005$ ) with the number of splashes in the fresh ham face (.69) and could be used as an indicator of blood splashing in the ham.

We concluded that although captive bolt stunning causes more blood splashing in pork muscle than other stunning methods, the time interval between stunning and bleeding is critical. Sticking pigs within 10 to 20 sec after stunning with a captive bolt will reduce blood splashing in the muscle and may make this method of stunning comparable to electrical stunning for amount of muscle blood splashing.

Table 1. Sex and Side of Carcass Effects on Blood Splashing in the Ham of Pigs for Studies I and II

Study/Factor	Barrows	Gilts
Study I <sup>a,b</sup>		
Captive bolt-short	1.1	1.1
Captive bolt-delayed	1.8	1.8
Study II <sup>a,c</sup>		
Captive bolt-short	1.3	2.3
Captive bolt-delayed	10.3	13.0
Electric-short	.7	.6
Electric-delayed	.8	.7
	<u>Left side</u>	<u>Right side</u>
Captive bolt-short	.6	1.0
Captive bolt-delayed	6.9	5.2
Electric-short	.2	.5
Electric-delayed	.4	1.5

<sup>a</sup>Means within a row were not different ( $P > .05$ ).

<sup>b</sup>Means for ham blood splashing scores:  
(1=none or practically none, 2=slight, 3=moderate, 4=severe).

<sup>c</sup>Means for number of blood splashes in the muscles of the fresh ham face.

Table 2. Blood Splashing Scores<sup>a</sup> of the Ham, Loin and Shoulder for Short and Delayed Time Intervals from Stunning to Bleeding in Study I

Locations	Short	Delayed
Ham	1.1 <sup>c</sup>	1.8 <sup>b</sup>
Loin	1.0 <sup>c</sup>	1.5 <sup>b</sup>
Shoulder	1.0 <sup>c</sup>	1.4 <sup>b</sup>

<sup>a</sup>1=none or practically none, 2=slight, 3=moderate, 4=severe.

<sup>b,c</sup>Means within a row with different superscript letters are different (P<.05).

Table 3. Blood Splashing Numbers in the Ham and Diaphragm Scores for Stunning Method and Stunning to Bleeding Time Interval Treatments in Study II

Location	Captive Bolt		Electric	
	Short	Delayed	Short	Delayed
Fresh ham face, number <sup>a</sup>	1.6 <sup>d</sup>	12.1 <sup>c</sup>	.7 <sup>d</sup>	1.9 <sup>d</sup>
Cured ham, number <sup>a</sup>	.2 <sup>d</sup>	2.2 <sup>c</sup>	.1 <sup>d</sup>	.4 <sup>d</sup>
Diaphragm, score <sup>b</sup>	1.0 <sup>d</sup>	2.3 <sup>c</sup>	1.1 <sup>d</sup>	1.2 <sup>d</sup>

<sup>a</sup>Means for number of blood splashes.

<sup>b</sup>1=none or practically none, 2=slight, 3=moderate, 4=severe.

<sup>c,d</sup>Means within a row with different superscript letters are different (P<.05).