EFFECT OF TRANSPORTING WEANED PIGS UNDER DIFFERENT SEASON ON MEAT QUALITY AND POSTMORTEM PROTEOLYSIS OF TWO PORCINE MUSCLES

Danyi Ma[1], Yufan Chao[1], Alan Duttlinger[1], Brian Richert[1], Jay Johnson[2], Yuan H. Brad Kim[1]*
[1]Department of Animal Sciences, Purdue University, West Lafayette IN 47907;
[2]USDA-ARS Livestock Behavior Research Unit, West Lafayette, IN 47907
Corresponding author: bradkim@purdue.edu

I. INTRODUCTION

Transporting weaned pigs to separated production facilities is a common production management practice in the pig industry to improve overall farming efficiency. During transport, piglets experience concurrent stressors from weaning and traveling simultaneously, which challenges physiological response, growth performance, and well beings of the animals during and after transport. While the most current published research focuses on the effect of transporting at weaning on health and productivity of growing pigs [1, 2], little to no information is available how these multiple stressors during the early phase of pig handling would affect the final productivity and meat quality attributes of the pigs reached the end phase of growth for marketing. Therefore, the objective of this study was to determine the effect of seasonal transport/weaning stress during the early phase of pig production on the carcass characteristics, meat quality and postmortem proteolysis of porcine muscles.

II. MATERIALS AND METHODS

Two groups of pigs were weaned at 19-day of age and transported in trailer trucks for 12 hours in two different seasons: thermal-challenged summer (HS) vs. thermal-neutral spring (NHS). After transport, all the pigs received diet supplemented with antibiotics chlortetracycline and tiamulin to alleviate stress for 14 days, and then fed with a normal basal diet. Upon reaching market weight, 20 pigs (n=10 from each transport season) were slaughtered. Both sides of the *longissimus dorsi* (LD) and *psoas major* (PM) muscles were separated at 1 day and 7 day postmortem, respectively. Carcass yield and quality, warner-Bratzler shear force (WBSF), color, proximate composition and water-holding capacity (WHC) including drip loss, thaw/purge loss, display loss, and cook loss were determined. Proteolysis profiles including desmin, troponin T, and calpain-1 autolysis were analyzed using western blot. Data were analyzed using PROC MIXED of SAS to compare the traits across transporting seasons, muscle types, and aging times. Least square means were separated by least significant differences ($P<0.05$).

III. RESULTS AND DISCUSSION

Overall, HS negatively impacted carcass yield and meat quality attributes. Increased HCW, backfat thickness, and marbling were found in NHS pigs ($P < 0.05$, data not shown). Specifically, muscles from pigs transported in HS during the early phase of pig production had significantly decreased tenderness, as evidenced by the higher WBSF values compared to the NHS counterparts ($P < 0.05$; Table 1). For WHC, muscles from the HS group exhibited higher thaw/purge loss and cook loss, resulting in 4.2% increase in total water loss compared to their NHS counterparts ($P < 0.05$; Table 1). Moreover, pigs transported under HS showed a decrease of intramuscular fat deposition ($P < 0.05$; Table 1), in accordance with marbling and back fat results. Significantly lower redness (CIE a*) was found in pork muscles from the HS group compared to muscle from the NHS group ($P < 0.05$), while hue angle (indication of discoloration) was increased with display, regardless of muscle types ($P < 0.05$; Table 1). Both muscles from HS pigs maintained higher intact products of desmin ($P < 0.05$) and tend to have less degradation product of troponin T ($P < 0.1$) compared to muscles from NHS pigs (Fig. 1). Delayed calpain-1 autolysis was found in the LD and PM muscles from the HS pigs compared to the NHS counterparts ($P <0.05$; Fig.1), indicating the decreased myofibrillar protein degradation would be likely associated with the decrease in capain-1 activity.

Table 1. Effects of wean/transport season (S) and muscle type (M) on instrumental tenderness (WBSF), water-holding capacity, and proximate composition of porcine muscles. LD: *Longissimus dorsi*; PM: *Psoas major*; HS: Heat-stressed transport; NHS: Non-heat-stressed transport.

		WBSF (N)	Water-holding capacity (%)				Proximate composition (%)		Instrumental display color		
			Drip loss	Display loss	Thaw loss	Cook loss	Protein	Lipid	CIE a*	CIE L*	Hue angle
LD	HS	48.2	5.11	7.15	9.58	25.37	22.89	2.39	10.12	52.12	47.11
	NHS	36.53	6.29	7.68	7.12	22.49	22.66	3.5	14.82	60.88	46.24
PM	HS	33.78	1.62	4.09	5.99	22.09	22.73	2.49	17.3	43.79	42.28
	NHS	30.17	1.67	4.26	2.98	20.03	21.58	2.81	19.48	51.41	40.37
P - value	Season	<.001	0.055	0.432	<.001	<0.001	<0.001	0.01	<0.001	<0.001	<0.001
	Muscle	<.001	<.001	<.001	<.001	<.001	<0.001	0.278	<0.001	<0.001	<0.001
	S * M	0.003	0.076	0.693	0.504	0.52	0.01	0.147	0.089	0.152	0.273

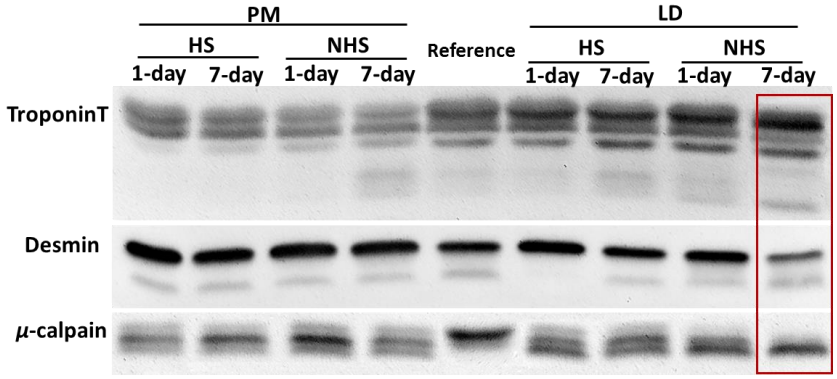

Figure 1. Representative western blots of troponin T, desmin, and calpain-1. LD: *Longissimus dorsi*; PM: *Psoas major*; HS: Heat-stressed transport; NHS: Non-heat-stressed transport. Reference was from 7-day aged pork LD for Troponin T and Desmin, and 45min postmortem LD for calpian-1.

IV. CONCLUSION

The results from the present study found that weaned pigs exposed to transport stress under thermal- challenging conditions during the early phase of pig production resulted in compromised carcass yield, meat tenderness, water-holding capacity, display color, and intramuscular fat deposition. These results suggest that a short-term stress during early phase of pig production could result in long-term negative impacts on the final quality attributes of fresh pork products. Further studies to determine the underlying mechanism by which the thermal challenging condition would affect the extent of proteolytic enzyme activities and subsequent protein degradation of muscles would be warranted.

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