INFLUENCE OF PRE-HARVEST STRESS AND SLAUGHTER TECHNIQUE ON BEEF QUALITY: PRELIMINARY RESULTS

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Abstract - The objective of this study was to determine if there is a difference in pre-harvest stress and carcass characteristics between kosher and not-qualified-as kosher cattle. Finished steers and heifers (n = 161) were slaughtered according to kosher law by a trained religious slaughter man. Number in pen, chute score, vocalization score, electrical prod use, time from gate to exsanguination, time from exsanguination to unconsciousness, and blood lactate were recorded. Carcass data was collected 24 h after chill and samples were taken from the 13th rib. Steaks (2.5-cm thick) were fabricated from each sample, vacuum packaged, aged for 14 d, and then frozen until analysis of Warner-Bratzler shear force (WBSF). Data were analyzed using the GLM and CORR procedures of SAS, using kosher as the source of variation in the model. Cattle that had a lower time from gate to exsanguination (P = 0.01) and vocalization score (P = 0.01) were more likely to qualify for kosher. Non-kosher carcasses had a larger REA (P = 0.02) and a lower (P < 0.0001) WBSF value. These data suggest that body composition and stress level may play a factor in the likelihood of a beef animal to qualify for kosher.

Key Words – kosher, quality, tenderness,

I. INTRODUCTION

Kosher food comes from biblical origins and has grown into a $200 billion food industry in 2009 [1]. Kosher slaughter is done by a trained religious slaughter man with no stunning of the animal prior to exsanguination permitted [2]. However this procedure does not solely make an animal acceptable for kosher consumption. Internal organs must be inspected, particularly the lungs. Lung adhesions are deemed not desirable, and may cause an animal to not qualify for kosher [1]. The objective of this study was to determine if there is a difference in pre-harvest stress and carcass characteristics between kosher and non-kosher beef cattle

II. MATERIALS AND METHODS

Trained university personnel travelled to New Rockford, ND, and observed kosher beef harvest (n = 161). Number of animals in lairage pens, chute score, vocalization score, and time from entering the v-belt to exsanguination (GtE) were the pre-harvest measurements that were recorded. Chute score (1 = calm, no movement; 2 = slightly restless; 3 = squirming, occasionally shaking the chute; 4 = continuous, very vigorous movement and shaking of the chute; 5 = rearing, twisting of the body and struggling violently) was adapted from Grandin [3] and recorded in the holding chute prior to entering the v-belt restrainer. [3] Vocalization scores (0 = no vocalization, 1 = low intensity, singular vocalization; 2 = mild intensity, one to two vocalization; 3 = high intensity, two or more vocalizations) were observed in the v-belt restrainer. Time was recorded from exsanguination to unconsciousness (EtU). Approximately 30 s after exsanguination, a 2-mL blood sample was collected to obtain a blood lactate concentration (Lactate Pro Meter, Arkray, USA Inc., Edina, MN). Carcass measurements were obtained approximately 24 h postmortem at North Dakota Natural Beef processing facility in Fargo, ND. Measurements included hot carcass weight (HCW), 12th rib fat (BF), rib eye area (REA), kidney pelvic and heart fat percentage (KPH), final yield grade (FYG), marbling score (Marb), as well as beef quality defects. A sample approximately 3.8-cm thick, was obtained at the 13th rib, placed in a labeled bag inside a cooler and transported to North Dakota State University's meats laboratory. Upon arrival 2.54-cm steaks were cut from each sample, and vacuum packaged via the Cryovac® (Duncan, SC). After aging for 14 d in darkness, steaks were frozen until they were removed and measured for tenderness by Warner-Bratzler shear force (WBSF). The

kosher data were obtained from North Dakota Natural Beef. Data was analyzed using Proc CORR and Proc GLM procedures of SAS (SAS Institute Inc., Cary, NC) with kosher as the source of variation in the model.

III. RESULTS AND DISCUSSION

Of cattle observed, 48% qualified as kosher. Characteristics of kosher and non-kosher carcasses are reported in Table 1. Kosher carcasses had larger REA (P = 0.02). WBSF values were lower for non-kosher carcasses (P < 0.0001) resulting in a more tender product. Kosher carcasses tended to have higher HCW (P = 0.09) and lower marbling scores (P = 0.09). This data suggests that kosher animals may phenotypically be larger, more muscular cattle.

Table 1. Least-squares means and standard errors for carcass characteristics of beef steers and heifers

Trait	Non-kosher	Kosher	P-value
HCW, kg	336.78 ± 8.15	354.84 ± 6.96	0.09
BF, cm	1.17 ± 0.10	1.14 ± 0.08	0.82
REA, cm^2	78.77 ± 1.87	84.71 ± 1.61	0.02
KPH, %	2.00 ± 0.01	2.00 ± 0.01	0.18
FYG	2.55 ± 0.13	2.38 ± 0.12	0.33
Marb	454 ± 18	413 ± 15	0.09
WBSF, kg	3.37 ± 0.17	4.28 ± 0.15	< 0.0001

Table 2 shows the relationship between pre-harvest measurements and qualified-for-kosher cattle. Qualified-for-kosher cattle were less vocal (P=0.01) and took less time from the gate opening to exsanguination (P = 0.01). This suggests that calmer, less excitable cattle may move faster through the system and have an increased chance to qualify as kosher.

Table 2. Least-squares means and standard errors for pre-harvest characteristics of beef steers and heifers

Trait	Non-kosher	Kosher	P-value
# in Pen	10.59 ± 0.35	10.26 ± 0.37	0.53
Chute score	2.97 ± 0.15	2.85 ± 0.16	0.60
Lactate	7.48 ± 0.60	7.78 ± 0.63	0.73
GtE	53.67 ± 1.92	46.49 ± 1.99	0.01
EtU	78.05 ± 2.75	83.19 ± 2.88	0.20
Vocal score	1.09 ± 0.15	0.47 ± 0.16	0.01
# of EP	1.03 ± 0.16	0.92 ± 0.17	0.64

Table 3 explores the partial correlation coefficients of the pre-harvest measurements. Lactate is directly correlated to chute score (P < 0.001) and surprisingly indirectly correlated to number of times an electric prod is used (P < 0.001). The time it takes from entering the v-belt to exsanguination was directly correlated with vocalization score (P < 0.001) and number of times an electrical prod was used. (P < 0.001)

Table 3. The partial correlation coefficients

	# in Pen	Chute Score	Lactate	GtE
Lactate	0.06	0.38***	1.00	
GtE	0.15	-0.16*	0.15	1.00
EtU	0.11	-0.09	-0.20*	-0.04
Vocal score	-0.23**	0.03	0.09	0.22***
# of EP	-0.15	0.21***	-0.26***	0.33***

*P-value < 0.05; **P-value < 0.01; ***P-value < 0.001

IV. CONCLUSION

In summary we found that cattle that are less vocal and move through the chute system easily have a greater chance to qualify as kosher. Also we found that larger, more muscular cattle appeared to qualify for kosher more often. Finally we found steaks taken from kosher carcasses to be less tender. This research is still on-going and more samples are being collected to help confirm our preliminary results.

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