UNITED STATES FRESH AND FROZEN AND AUSTRALIAN FROZEN GOAT CARCASS TRAITS AND MEAT YIELDS

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Abstract – Forty goats in two groups were purchased from local U.S. sources and humanely slaughtered. Uniform young maturity carcasses (n = 30) were retained after carcass evaluation. Frozen Australian goat carcasses (2 groups of n = 20) were procured from a commercial importer and the most uniform carcasses (n=30) were used. The U.S. carcasses were split into sides and the right side frozen and stored for 6 weeks. Left sides were fabricated into standardized primal cuts. After frozen storage, right sides and Australian carcasses were thawed for 3 days at 4°C before carcass evaluation. U.S. carcasses were heavier (P<0.05) with higher (P<0.05) external fat, but carcass conformation and lean flank color were not different than for imported Australian goat carcasses. Freezing and thawing carcass sides resulted in minimal thaw losses. Australian carcasses were leaner, had less waste, and had higher trimmed primal loin, rack, leg, shank, and shoulder yields (as % of carcass weight) than fresh U.S. sides. Freezing and thawing caused the percentages of cuts to change, but Australian goat carcasses generally had higher (P<0.05) yields of lean trimmed primal cuts.

Key words - frozen, imported meat, primal cuts

I. INTRODUCTION

Increased quantities of frozen goat meat are imported into the U.S. from Australia and New Zealand to meet the demand for goat meat, primarily from ethnic consumers. Imports of goat meat have increased over the past two decades with more than 19,630,658 kg imported into the U.S. in 2014, a number that increased nearly 50% since 2010. Imported goat meat, mostly frozen and from Australia, comprised more than 66% of the goat meat consumed in the U.S. in 2014 that can be verified [1]. Although type of cut accounted for 68% of the variation in respondent preferences, consumers valued fresh domestic over frozen domestic or frozen imported goat meat [2]. Freezing meat prolongs the shelf life, but freezing and thawing processes affect the quality of the meat. Tenderness of meat as peak force is generally thought to decrease with freezing and thawing [3]. The percentage of water loss within carcass and cuts is also expected to increase as a percentage with frozen carcasses [4].

The present study was designed to compare carcass differences and carcass yield differences of primal cuts from representative frozen Australian goat carcasses and from representative U.S. kid goats after both fresh and frozen storage. The hypotheses were that fresh and frozen U.S. goat meat carcasses would have higher percentages of primal cuts than frozen Australian goat carcasses and that U.S. goat carcasses would have higher carcass conformation, fat, and flank color scores. It was expected to see lower cut yields from frozen domestic (U.S) goat meat than with fresh domestic goat meat.

II. MATERIALS AND METHODS

This experiment was conducted in two replications with fresh domestic goat sides and frozen domestic goat sides from U.S. goats, and imported frozen Australian goat carcasses.

Two groups of 20 kid meat goats (n=40) were

purchased from local domestic sources. Goats were humanely slaughtered under state meat inspection program supervision. After overnight chilling at 4°C, carcass conformation was evaluated and estimates of the kidney, pelvic, and heart fat (KPH); flank color; and fat score were recorded. All measurements were taken using standard guidelines [5]. After removing carcasses with spool joints, the most uniform carcasses (n = 30) were then selected based on the carcass evaluation. Spool joints are an indication of older animals due to greater conversion of cartilage to bone within the joint [6].

Fabrication began with the neck being removed from the carcasses using a band saw. Carcasses were split along the vertebral column into left and right sides with the band saw. The neck and each side were weighed. Left sides were rehung for one day to be fabricated as fresh domestic sides. Right sides were wrapped in multiple layers of 0.6 mil polyvinyl chloride (PVC) barrier film before being frozen in a -33°C blast freezer and stored for 6 weeks until thawed.

The kidney, pelvic, and heart fat (KPH) were removed from the fresh domestic sides and weighed. Then the sides were cut according to USDA Institutional Meat Purchase specifications Hotel style with an additional straight cut immediately anterior to the femur-pelvic joint on the posterior end (as shown in IMPS Food Service style) [7]. The additional cut removed the sirloin portion from the leg for a later experiment. The weight of each cut (loin plus sirloin, rack, leg, hind shank, rib, shoulder, and fore shank) was obtained. The trotters along with miscellaneous bone fragments and meat trimmed from the cuts were deemed as waste.

Two groups of 20 frozen Australian goat carcasses (n=40) were obtained from a commercial importer and transferred to a -33°C storage freezer upon receipt. After slaughter in the Brooklyn, Victoria, Australia plant, the carcasses were chilled for approximately 8 hours (4°C), then blast frozen for approximately 24 hours at -30°C before being loaded into shipping containers at -21°C. Transit time from Australia to the Philadelphia, Pennsylvania, U.S.A., port of entry was 4 weeks [8].

Frozen imported carcasses and frozen domestic sides were thawed at 4°C for 3 days. Australian carcass were hung on hooks and evaluated for the same criteria as the domestic carcasses. Following evaluation, carcasses were weighed, the neck removed and weighed, and then carcasses were split along the vertebral column into right and left sides. Right sides were weighed and retained for the remainder of the experiment.

Prior to data analysis, all weights were converted to percent of carcass and percent of side (thawed side for frozen carcasses) for comparative purposes. All data was analyzed with SAS 9.4. Weight and evaluation scores were compared for domestic and imported carcasses using the Proc TTest function. Primal cut yield data was analyzed with Proc GLM for comparison of group means using the Tukey function. Paired T-tests were conducted for fresh domestic and frozen domestic sides from the same carcass. Paired data was analyzed using the Proc Paired TTest function. Significance for all statistical analyses was determined at $P<0.05$.

III. RESULTS AND DISCUSSION

Domestic carcasses had higher ($P<0.05$) mean weights than the imported Australian carcasses (Table 1), with Australian carcasses having a lower ($P<.05$) fat score, which indicated that the carcasses were leaner. Conformation score and flank color between the two groups were not different ($P>.05$).

The primal cuts from fresh domestic, frozen domestic and imported Australian carcasses were calculated as percentages of carcass weight (Table 2). There were no differences ($P>0.05$) in percentages of loin, rack, and leg between frozen domestic and frozen Australian goat carcasses. The percentages of rack and leg for frozen domestic and frozen Australian were different ($P<0.05$) than for the fresh domestic cuts, but there were no differences ($P>0.05$) in percentages of rib and fore shank among the three groups. Australian goat carcasses had higher ($P<0.05$) percentages of hind shank and shoulder than the domestic fresh and frozen carcasses. Waste was a higher ($P<.05$) percentage of domestic fresh and

frozen carcasses than the Australian frozen carcasses.

Table 1 Means and S.E.M. of carcass traits for U.S. domestic and Australian imported goat carcasses

Trait \ Group	U.S. domestic	Australian imported
Carcass weight, kg	15.49[a]	13.76[b]
	1.12	1.77
Conformation score [5]	236.67[a]	243.67[a]
	7.43	5.33
Flank color [5]	180.00[a]	178.33[a]
	6.25	6.36
Fat score [5]	1.79[a]	1.69[b]
	0.18	0.49

[ab]means with different letters in the same row are different (<0.05)

Table 2 Primal cuts as percentages of carcass weight without neck or kidney, pelvic, and heart fat

Primal cut	Fresh domestic	Frozen domestic	Frozen Australian	S.E.M.
Loin	13.67[a]	13.75[ab]	14.21[b]	0.002
Rack	7.67[a]	8.53[b]	8.56[b]	0.002
Leg	20.16[a]	20.95[b]	20.42[ab]	0.003
Hind shank	3.50[a]	3.42[a]	3.98[b]	0.001
Rib	13.66[a]	13.05[a]	12.41[a]	0.003
Shoulder	26.77[a]	26.4 [a]	29.38[b]	0.003
Fore shank	4.67[a]	4.53[a]	4.29[a]	0.001
Waste	9.63[a]	9.25[a]	6.41[b]	0.002

[ab]means with different letters in the same row are different (<0.05)

Primal cuts as a percentage of side weight were not different (P>0.05) for rib and hind shanks (Table 3). Loins, hind shanks, and shoulders were a higher (P<.05) percentage of the thawed Australian side weights than the fresh or frozen domestic sides. Australian frozen and domestic frozen racks were a higher (P.05) percentage of sides than fresh domestic sides. These percentages were similar to those reported previously for domestic and imported goat carcass cut yields [9]. Australian frozen and thawed sides also had less waste than domestic frozen and thawed or unfrozen goat carcass sides.

Paired comparisons indicated that fresh domestic right sides weighed more (P<0.05) than the fresh domestic left sides. The reason was more likely not because there were true differences in side weights, but likely because cutting goat carcasses into identical sides with a band saw is difficult. Left and right side symmetry was reported for beef carcasses [10] Weight of fresh domestic left sides did not differ (P>0.05) from frozen and thawed domestic right sides. The thawing loss of right sides was %.

Table 3 Primal cuts as percentages of thawed side weight without kidney, pelvic and heart fat

Primal cut	Fresh domestic	Frozen domestic	Frozen Australian	S.E.M.
Loin	6.23[a]	6.33[a]	6.68[b]	0.001
Rack	3.50[a]	3.93[b]	4.03[b]	0.001
Leg	9.18[a]	9.63[b]	9.59[ab]	0.001
Hind shank	1.59[a]	1.56[a]	1.87[b]	<0.001
Rib	6.22[a]	6.00[a]	5.84[a]	0.001
Shoulder	12.19[a]	12.16[a]	13.81 [b]	0.002
Fore shank	2.13[a]	2.07[a]	2.01 [b]	<0.001
Waste	4.39[a]	4.26[a]	3.01[b]	0.001

[ab]means with different letters in the same row are different (<0.05)

IV. CONCLUSION

Commercially available imported frozen Australian goat carcasses were leaner than U.S. domestic carcasses even though the subjective conformation scores and flank color did not differ. Freezing carcass sides minimally decreased the thawed carcass or side weights, but did alter the percentages of primal cuts. The differences in primal cut yields was principally due to differences in carcass leanness and trimming waste.

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