

# EVALUATION OF SKIN-ON GOAT MEAT PROCESSING ON YIELD, PROCESSING TIME AND CHINESE CONSUMER PREFERENCE IN THE U.S.

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## I. INTRODUCTION

The traditional American diet prefers skinless, semi-boneless goat meat [1]. However, this style of goat processing exhibits low overall yield [2]. On the other hand, many Asian cultures enjoy bone-in goat meat cubes with skin attached because of the cooked skin's unique texture and flavor. Skin, bones, tendons and cartilages represent approximately 50% of goat carcass weight and can be sold for profit instead of being treated as waste. With the growing Asian population in the U.S., there is potential to grow the goat meat market to meet the new demand [3]. Unfortunately, the skin-on goat meat processing technology has not been developed in the U.S., leading the industry to increase its reliance on skin-on goat meat imports from Australia to fulfill the demand [4, 5]. Therefore, the objective of this study was to evaluate yields and time efficiency between the skin-on and skin-off harvest and fabrication processes, along with comparing Asian American consumers' preference for U.S. and Australian skin-on goat meat.

## II. MATERIALS AND METHODS

Seventeen Boer/dairy crossbred goats averaging 26.3 kg and 4 months of age were harvested at California State University-Chico (CSU) Meats Laboratory with 2 different harvesting techniques: 9 with skin left on the carcasses (skin-on) and 8 with skin removed (skin-off). In the skin-on harvest group, carcasses were scalded and dehaired at 61°C for 3 minutes to remove most of the hair after stunning and exsanguination. The skin-off harvest group was harvested the same as the traditional lamb harvest, using the fisting technique (Figure 1). All carcasses were fabricated using a bandsaw and cut into 5 cm x 5 cm cubes after 24 hours of postmortem chilling at 2 °C. Live weight, hot carcass weight, dressing %, chilled carcass weight, final retail product weight, harvest time and fabrication time were recorded throughout the harvest and fabrication processes. Meat cubes from one hind leg was removed from 5 randomly selected skin-on goat carcasses



Figure 1. Representative examples of skin-on (left) and skin-off (right) goat carcasses.

and stored at -20 °C. Five Australian imported skin-on goat hind legs were purchased from an Asian ethnic supermarket in Sacramento, CA, U.S., cut into 5 cm x 5 cm cubes and transported back to the CSU Meats Laboratory in frozen condition. On the sensory evaluation day, 2 kg of hind leg meat cubes from each animal (5 U.S. and 5 Australian) were cooked in ten identical pots (7.5 liters), broth (water, rice cooking wine, green onion and salt) and cooking time (2 hours) on ten identical gas burners with the same heat setting (low). Twenty-eight Chinese/Chinese American consumer panelists were recruited from Chico, CA, U.S. and evaluated appearance, flavor, juiciness, texture and overall liking of all ten samples in one session on a 9-point hedonic scale (1=Dislike extremely and 9=Like extremely). Data were analyzed by GLIMMIX procedure of SAS (University Edition, version 9.4) as a Completely Randomized Design.

## III. RESULTS AND DISCUSSION

The skin-on group had greater dressing %, % chilling loss and % total yield ( $P < 0.01$ ) compared to the skin-off group. There were no differences between treatments for harvest time, fabrication time, and total processing time ( $P > 0.10$ ; Table 1). In addition, consumer panelists did not detect any difference in appearance, flavor, juiciness, texture and overall liking ( $P > 0.10$ ) between U.S. and Australian skin-on goat meat (Table 2). Background survey from this study further indicated that Chinese ethnic consumers considered quality and price as the two most important factors for meat purchasing decisions, whereas the country-of-origin of meat products had little to no importance to them.

Table 1. Comparison of yield and processing time between skin-on and skin-off goat harvesting methods.

	Treatments		SEM	P-Values
	Skin-On	Skin -Off		
<b>Yield</b>				
Hot Carcass Weight (kg)	13.80	14.74	0.68	0.51
Dressing %	61.00	48.34	1.90	<0.01
% Chilling Loss	6.53	3.15	0.73	0.01
% Retail Yield	82.22	85.27	1.03	0.07
% Total Yield	51.16	41.36	1.39	<0.01
<b>Processing Time</b>				
Harvest Time (min)	21.35	20.57	1.42	0.79
Fabrication Time (min)	14.20	12.94	0.55	0.27
Total Processing Time (min)	35.55	33.51	1.64	0.55

Table 2. Consumer panel ratings<sup>1</sup> of U.S. and Australian skin-on goat meat.

	Treatments		SEM	P-Values
	U.S.	Australian		
Appearance	6.23	6.28	0.12	0.86
Flavor	6.06	6.29	0.19	0.59
Juiciness	6.32	6.21	0.22	0.82
Texture	6.08	6.24	0.24	0.76
Overall	6.05	6.33	0.22	0.55

<sup>1</sup>sensory scores: 1=Dislike extremely and 9=Like extremely.

Our yield data for skin-off goat carcass matched the results from McGregor [7]. However, it is to the best of our knowledge that yield and processing time data on skin-on goat processing are currently none existent in the agricultural science data base. In addition, it has long been known that environmental factors in small ruminant production systems can affect the quality and sensory results of goat and lamb meat [6]. However, our sensory results showed no apparent differences in sensory attributes between U.S. and Australian skin-on goat meat for Chinese/Chinese American consumers. It is likely that the slow moist heat cookery in combination with broth containing salt, rice cooking wine and green onion masked the sensory differences. This cooking method was designed to replicate conventional skin-on goat stew in many Asian ethnic cuisines, but it may not be best suited for consumer panel.

#### IV. CONCLUSION

Our results are encouraging to U.S. goat producers and processors who are interested in this ethnic niche goat market as the skin-on process requires similar inputs, but generates additional outputs in comparison to skin-off harvesting. On the other hand, consumer panel data suggested that U.S. skin-on goat meat had no sensory advantage over the Australian skin-on goat meat under the conventional moist heat cookery and must be competitively priced compared to its competitors to capture market share. Additional economic research on consumer's willingness-to-pay for U.S. skin-on goat meat for Chinese and other Asian ethnic groups are needed to determine the sustainability of this niche meat product in the current U.S. market.

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