THE EFFECT OF MUSCLE SOURCE ON GROUND BEEF FLAVOR AND TEXTURE

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I. INTRODUCTION

Ground beef accounts for 60% of total U.S. beef consumption (1), with 8 out of 10 U.S. foodservice establishments serving hamburgers. Additionally, the value of ground beef has gradually increased, as reflected by a steady decline in the price difference between steaks and ground beef (1). Driven by high demand and increased value, foodservice establishments have focused on developing "premium" ground beef blends (2). Muscles throughout the beef carcass are known to have varying flavor and texture profiles (3). Thus, the objective of this study was to evaluate the effect of muscle source on ground beef flavor and texture in formulating "premium" ground beef blends.

II. MATERIALS AND METHODS

Seven ground beef treatments represented 6 USDA Choice whole muscle sources (shoulder clod, chuck short rib, brisket, sirloin cap, knuckle, and tenderloin tips) and 1 trim source (81/19 chuck trimmings). Whole muscle cuts were vacuum packaged and aged for 10 days, whereas, chuck trimmings were stored in plastic lined combos and processed 6 days postmortem. Using crude fat estimates from the USDA Nutrient Database Standard Reference, 5 replicate batches were formulated from 4 randomly assigned subprimals to contain 15% fat. Five replicate batches of chuck trimmings were ground to represent a more traditional ground beef blend for baseline comparison. Each batch was formed into 151 g patties and frozen at -20°C until analysis. Panelists were trained to evaluate samples for standard beef flavor and textural attributes on a 10 cm continuous line scale. Patties were cooked to 71°C on griddle pans over open gas burners and cut into 8 wedge-shaped pieces for evaluation. Total lipid fatty acids were analyzed from 1 g of homogenized raw sample. Fatty acid methyl esters (FAME) were quantified via gas chromatography, with each FAME reported as a percentage of the total amount of FAME identified. Volatile flavor compounds were measured from cooked patties. Cooked sample was placed in a capped glass vial and volatiles were collected from the headspace via a solid phase microextraction fiber. Quantification was carried out using a 7-point internal standard method and compounds were identified from authentic external standards. Treatment comparisons for all analyses were tested for significance using the general linear model procedure of SAS.

III. RESULTS AND DISCUSSION

No whole muscle source outperformed ($P > 0.05$) chuck sourced trimmings for flavor attributes. However, patties from briskets and sirloin caps were rated similarly high ($P > 0.05$) to chuck sourced trimmings for desirable beefy/brothy, browned/grilled, and buttery/beef fat flavor notes, as well as, similarly low ($P > 0.05$) for livery and sour/acidic off flavors. In contrast, patties from tenderloin tips were rated lowest ($P < 0.05$) for beefy/brothy, browned/grilled, and buttery/beef fat flavors and the highest ($P < 0.05$) for sour/acidic notes among all ground beef sources. Patties from chuck sourced trimmings had the greatest ($P < 0.05$) amounts of connective tissue, the greatest ($P < 0.05$) peak load force, and the coarsest mouthfeel ($P < 0.05$) of all ground beef sources. Fatty acid profile was affected ($P < 0.05$) by ground beef source (Table 1). Generally, brisket patties had increased ($P < 0.05$) concentrations of monounsaturated fatty acids, which have previously been related to desirable flavor attributes (4). Tenderloin tip patties had the greatest ($P < 0.05$) concentrations of stearic acid and the lowest ($P < 0.05$) concentrations of oleic acid. Volatile compounds varied ($P < 0.05$) due to muscle source. Several ketones were influenced ($P < 0.05$) by muscle source and showed positive associations ($P < 0.05$) with beefy/brothy and browned/grilled flavor notes. Whereas, alcohols generally showed positive relationships ($P < 0.05$) with sour/acidic notes and negative relationships ($P < 0.05$) with beefy/brothy, browned/grilled, and buttery/beef fat flavors.

Table 1. Concentrations[1] of identified fatty acids in ground beef patties representing 7 beef sources.

	Treatment								
Fatty Acid	Shoulder Clod	Short Ribs	Brisket	Sirloin Cap	Knuckle	Tenderloin Tips	Chuck Trimmings	SEM	P-value
C10:0	0.07	0.06	0.08	0.06	0.05	0.06	0.07	0.007	0.226
C12:0	0.11^{a}	0.08^{bc}	0.10^{ab}	0.08^{c}	0.09^{abc}	0.09^{abc}	0.09^{abc}	0.005	0.004
C12:1	0.04	0.03	0.03	0.03	0.04	0.03	0.04	0.003	0.277
C14:0	3.66^{a}	3.15^{e}	3.39^{bcd}	3.28^{de}	3.58^{ab}	3.34^{cde}	3.53^{abc}	0.053	< 0.001
C14:1	1.09^{a}	0.55^{c}	0.98^{a}	0.74^{b}	0.76^{b}	0.35^{d}	0.66^{bc}	0.029	< 0.001
C15:0	0.62^{bc}	0.61^{bc}	0.63^{bc}	0.64^{abc}	0.69^{a}	0.59^{c}	0.67^{ab}	0.013	< 0.001
C15:1	0.05	0.04	0.05	0.04	0.04	0.02	0.06	0.007	0.061
C16:0	26.88^{a}	25.36^{bc}	25.16^{c}	26.10^{abc}	26.06^{abc}	25.85^{abc}	26.48^{ab}	0.293	0.004
C16:1c9	4.05^{a}	2.75^{c}	3.86^{a}	3.08^{bc}	3.64^{a}	2.02^{d}	3.18^{b}	0.096	< 0.001
C17:0	1.37^{d}	1.77^{ab}	1.65^{bc}	1.88^{a}	1.62^{bc}	1.54^{cd}	1.65^{bc}	0.046	< 0.001
C17:1	0.92^{b}	0.87^{b}	1.16^{a}	1.01^{ab}	1.03^{ab}	0.52^{c}	0.85^{b}	0.042	< 0.001
C18:0	13.17^{cd}	17.21^{b}	12.20^{d}	14.28^{c}	13.94^{c}	23.75^{a}	16.18^{b}	0.359	< 0.001
C18:1t total	1.99^{c}	3.56^{ab}	3.48^{ab}	4.01^{a}	2.94^{bc}	3.11^{ab}	3.53^{ab}	0.217	< 0.001
C18:1c9	33.74^{a}	32.58^{ab}	35.03^{a}	32.82^{ab}	33.60^{a}	26.88^{c}	30.10^{b}	0.663	< 0.001
C18:2 total	1.95^{b}	1.65^{c}	2.29^{a}	1.81^{bc}	1.98^{b}	1.31^{d}	1.72^{bc}	0.058	< 0.001
C18:2t total	0.53	0.48	0.58	0.45	0.59	0.56	0.49	0.056	0.512
C18:3	0.73^{ab}	0.74^{ab}	0.59^{ab}	0.57^{ab}	0.94^{a}	0.96^{a}	0.45^{b}	0.104	0.011
C18:3 n-3	0.16	0.22	0.11	0.19	0.11	0.20	0.18	0.043	0.469
C20:1c11	0.22^{ab}	0.20^{ab}	0.27^{a}	0.20^{ab}	0.19^{ab}	0.16^{b}	0.21^{ab}	0.019	0.031
C20:2	0.71	0.75	0.69	0.87	0.37	0.39	0.95	0.143	0.057

[1]Data presented are least squares means for the normalized weight percentage of each fatty acid, expressed as a percentage of total fatty acid weight.

[abcde] Least squares means in the same row lacking a common superscript differ (P<0.05)

IV. CONCLUSION

Ground beef source clearly altered sensory attributes, which showed to be influenced by varying fatty acid and volatile compound profiles. Although no whole muscle source increased the flavor profile of ground beef over a more traditional chuck trim sourced patty, patties blended from briskets and sirloin caps maintained a similar flavor profile, while improving several textural attributes. Therefore, there is the opportunity to utilize lower value subprimals in creating "premium" ground beef blends for foodservice establishments.

ACKNOWLEDGEMENTS

Funding for this project was funded by the Beef Checkoff.

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