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Effects of Aging on Beef Chuck and Round Muscles Enhanced with Ammonium Hydroxide and Salt

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Summary

This study was conducted to determine if aging alters the beneficial effects of enhancement with a 20% solution of water, ammonium hydroxide, and salt, on beef steaks. For all muscles (triceps brachii, biceps femoris, rectus femoris), steaks had lower shear force values when compared to non-pumped controls at every aging period (1, 7, 14 days). Also, enhanced steaks received more desirable evaluations for tenderness, juiciness, flavor, and overall acceptability at every aging period from consumer taste panels. These data indicate aging does not decrease the benefits of enhancement.

Introduction

In an earlier phase to this project, it was shown that beef chuck and round muscles enhanced with a water, ammonium hydroxide, and salt solution are more tender than nonenhanced muscles. In addition, enhanced steaks had higher (more desirable) connective tissue ratings, were juicier, and had less off-flavor than nonenhanced steaks. Also, the optimum pump level for these muscles was determined to be 20%.

During aging of meat, proteins that give a muscle its structure and functionality break down. Aged meat is generally more tender than unaged meat. The objectives for this study were to determine if the benefits of enhancing beef chuck and round muscles with ammonium hydroxide and salt are reduced by aging.

Procedure

This study examined effects of aging on enhanced and nonenhanced (control) beef chuck and round muscles. Beef subprimals (clod hearts, sirloin caps, and knuckles; n=72 each) were randomly assigned to each treatment (enhanced or control), aging period (1, 7 14 days), and one of three replications. Enhanced subprimals were injected with a solution containing water, ammonium hydroxide, and salt (patent pending technology from Freezing Machines, Inc.) to a 20% target pump level at Beef Product Inc.'s facility in Dakota City, Neb. Three steaks were cut from each subprimal to a thickness of 1 inch, trimmed of excess fat and muscles, and packaged in a modified atmosphere package (80% oxygen, 20% carbon monoxide). Steaks were then shipped to the University of Nebraska Loeffel Meat Lab. At the end of each aging period steaks were removed from the modified atmosphere package, vacuum packaged, and frozen. Steaks (triceps brachii, biceps femoris, and rectus femoris) were then used for determination of Warner-Bratzler shear force and consumer taste panel ratings. Thaw loss, cook loss, and cook time were also recorded when steaks were cooked to 158° F for Warner-Bratzler shear force and consumer taste panels. Consumer taste panels evaluated steaks for desirability of tenderness, connective tissue, juiciness, flavor, and overall acceptability on an 8-point scale (8 = extremely desirable, 1 = extremely undesirable).

Results

For all muscles, enhanced steaks had lower shear force values than the controls at every aging period. Figure 1 shows the Warner-Bratzler shear force differentials between control and pumped steaks. After aging for one day, shear forces from control steaks were 2.14, 2.27, and 3.04 lb higher than enhanced steaks for the triceps brachii, biceps femoris, and rectus femoris, respectively. At

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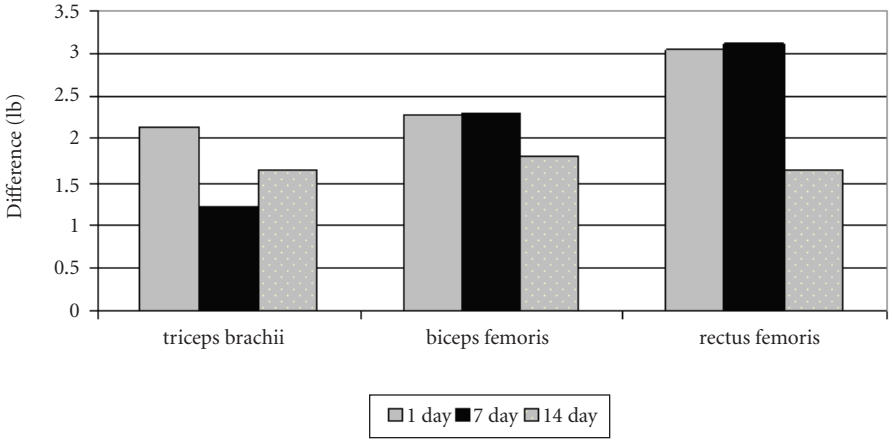

Figure 1. Warner-Bratzler shear force differentials (CONTROL – PUMP) at 1, 7, and 14 days of age.

day 7 of age, shear forces for control steaks were 1.23, 2.31, and 3.11 lb higher than enhanced steaks (triceps brachii, biceps femoris, and rectus femoris, respectively). After 14 days of aging, shear forces for control steaks were 1.65, 1.81, and 1.65 higher than enhanced steaks for the respective muscles above.

Figure 2 shows the differences in consumer taste panel evaluations for overall acceptability between enhanced and control steaks. At day 1 of age, enhanced steaks were rated 1.31, 1.63, and 1.67 points higher than control for the triceps brachii, biceps femoris, and rectus femoris, respectively. At day 7 of age, enhanced steaks were rated 0.91, 1.28, and 1.28 points higher than control steaks for the respective muscles. After 14 days of aging, enhanced steaks were rated 1.30, 1.93, and 1.40 points higher than control steaks for the respective muscles above. Table 1 shows that for every muscle, enhanced steaks were always more desirable than control steaks in terms of tenderness, juiciness, off-flavor, and overall acceptability. These data indicate aging does not decrease the benefits (tenderness, juiciness, and flavor) of enhancement.

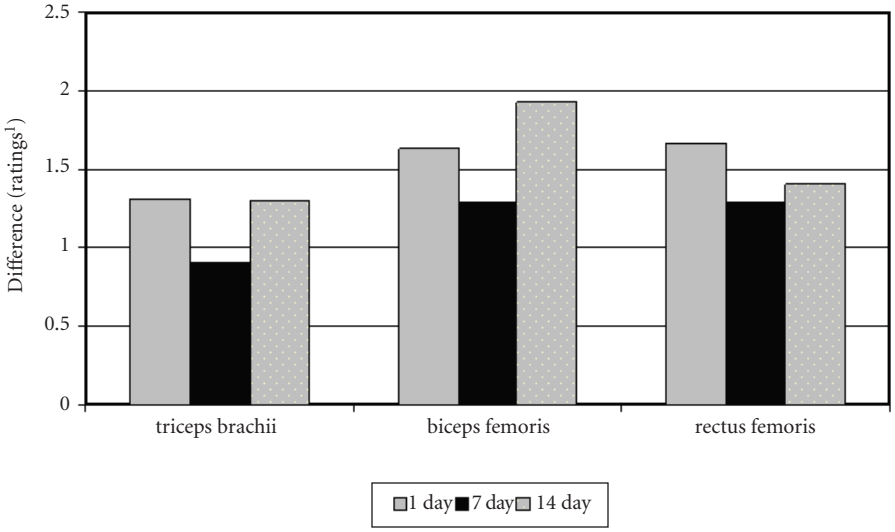

Figure 2. Consumer taste panel differentials for 'overall acceptability' (PUMP – CONTROL) at 1, 7, and 14 days of age.

Table 1. Consumer taste panel ratings[1] and Warner-Bratzler shear force values[1]

	Consumer Taste Panel Ratings[2]				
Muscle	Tenderness	Juiciness	Off-flavor	Overall Satisfaction	Warner-Bratzler shear force2
Triceps brachii					
Control	4.23[a]	4.13[a]	4.10[a]	4.07[a]	10.91[b]
Pump	5.40[b]	5.32[b]	4.93[b]	5.11[b]	9.21[a]
SE	0.09	0.09	0.10	0.10	0.20
Aging time, days					
1	5.24[y]	5.10[y]	5.15[z]	5.16[z]	9.15[x]
7	4.67[y]	4.62[x]	4.57[y]	4.56[y]	10.60[y]
14	4.53[x]	4.46[x]	3.84[x]	4.05[x]	10.43[y]
SE	0.16	0.13	0.11	0.14	0.28
Biceps femoris					
Control	4.62[a]	4.49[a]	4.33[a]	4.32[a]	8.53[b]
Pump	6.23[b]	5.74[b]	5.29[b]	5.55[b]	6.39[a]
SE	0.13	0.11	0.10	0.09	0.11
Aging time, days					
1	5.71[y]	5.36[y]	5.29[z]	5.38[z]	6.75[x]
7	5.41[xy]	5.11[xy]	4.92[y]	5.01[y]	7.28[x]
14	5.16[x]	4.87[x]	4.22[x]	4.42[x]	8.38[y]
SE	0.15	0.12	0.11	0.11	0.14
Rectus femoris					
Control	3.67[a]	3.61[a]	3.72[a]	3.47[a]	10.49[b]
Pump	5.12[b]	4.94[b]	4.79[b]	4.81[b]	7.89[a]
SE	0.15	0.11	0.09	0.10	0.14
Aging time, days					
1	4.59[y]	4.62[y]	4.72[z]	4.53[y]	9.15
7	4.56[y]	4.36[y]	4.37[y]	4.27[y]	9.04
14	4.04[x]	3.85[x]	3.67[x]	3.62[x]	9.41
SE	0.17	0.19	0.15	0.17	0.17

[1]Based on an 8-pt scale: 8 = extremely desirable, 1 = extremely undesirable
[2]Warner-Bratzler shear force is expressed as lb-force
[a,b]Means in the same column (for each muscle) that do not have common superscripts differ ($P<0.05$)
[x,y,z] Means in the same column (for each muscle) that do not have common superscripts differ ($P<0.05$)

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[2]This project was funded in part by beef and veal producers and importers through their $1-per-head checkoff and was produced for the Cattlemen's Beef Board and state beef councils by the National Cattlemen's Beef Association.