Effects of Sugar, Internal Cooking Temperature, and
Hot-Boning on the Characteristics of
Low Fat, Restructured, Value-Added Beef Roasts

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Summary

Low fat, restructured beef roasts were made from muscles that were
cconventionally or hot-boned. Differing combinations of salt, phosphate, and glucose
were added. Then roasts were cooked to 145 F or 200 F. Roasts from conventionally
boned muscle generally had less warmed-over flavor and higher acceptability scores
than those from hot-boned muscle. Adding glucose with salt and phosphate helped
suppress warmed-over flavor throughout display and did not reduce flavor acceptability
or increase cooking loss. Roasts cooked to 200 F had lower warmed-over flavor
scores and were more acceptable, but were less cohesive and had higher cooking
losses than roasts cooked to 145 F. All roasts were acceptable, regardless of boning,
ingredient, or temperature treatment.

Introduction

When "restructured" meat products are precooked, an undesirable "warmed-over"
flavor may become evident and the desirable beef flavor may become less intense.
"Warmed-over flavor" is due to rancidity of fats. Salt, which is used in restructuring
meat, encourages both rancidity and color deterioration. Adding certain sugars and
cooking at high temperatures may help prevent rancidity. The use of hot-boned meat
may also help decrease rancidity, as well as increase the cohesiveness of restructured
roasts. Consumer acceptability of pre-cooked, restructured, beef roasts can be
increased through: 1.) improved flavor, 2.) improved color, 3.) elimination of added
salt, 4.) decreased fat levels, and 5.) greater convenience. The objective of our study
was to evaluate the effects of: 1.) conventional vs. hot-boning, 2.) added glucose, and
3.) internal cooking temperature on flavor and color characteristics of low fat,
restructured, beef roasts.

Experimental Procedures

Meat from six Holstein steers was used to produce low fat, restructured beef
roasts. Muscles were removed by either conventional or hot-boning, then were blade
tenderized and ground. Meat batches (90% coarse plus 10% fine ground meat) then
were subjected to four ingredient additions: 1.) 4% water, 2% NaCl, 0.5% phosphate, 2%
glucose; 2.) 4% water, 2% NaCl, 0.5% phosphate; 3.) 4% water, 2% NaCl, 2% glucose;
and 4.) 4% water, 0.5% phosphate, 2% glucose. The resulting restructured roasts were
cooked to an internal temperature of either 145 or 200 F. Slices of the roasts were
displayed (refrigerated, wrapped with plastic film, and placed under lights for 24
hours/day) for 10 days. Meat was evaluated for consumer acceptability and
rated for flavor by a trained panel.

1 Appreciation is expressed to the Cattlemen's Beef Promotion and Research Board for
support of this research.
Results and Discussion

Results of the study are shown in Table 24.1. As expected, roasts without added salt and those cooked to 200 F had less moisture, were less cohesive, and had more cooking loss than roasts with added salt and those cooked to 145 F. However, roasts cooked to 200 F received higher consumer acceptability scores, and were perceived to have less warmed-over flavor than those cooked to 145 F (Figure 24.1). Roasts from conventionally boned muscles were more acceptable than those from hot-boned muscles when cooked to a low internal temperature. Roasts with salt, phosphate, and glucose, or salt and phosphate had the highest acceptability scores, whereas roasts with phosphate and glucose had the lowest. All roasts were scored acceptable, regardless of ingredient treatment. Warmed-over flavor, pH values, and cooking yields were higher for hot-boned roasts than conventionally boned roasts when a difference existed. Roasts with salt, phosphate, and glucose maintained the lowest level of warmed-over flavor (Figure 24.1). These data show that adding glucose to a salt and phosphate mix for restructured beef roasts will help maintain low warmed-over flavor scores, without affecting acceptability or yield.

Table 24.1. Mean Values for Consumer Acceptability Scores of Restructured Beef Roasts as Affected by Ingredient and Boning x Temperature Treatments

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Acceptability Scoresa</th>
<th>Acceptability Internal Temp.</th>
<th>Scoresab</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>HB</td>
</tr>
<tr>
<td>salt, phos.</td>
<td>3.25c</td>
<td>145 F</td>
<td>4.26c</td>
</tr>
<tr>
<td>glucose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>salt, phos.</td>
<td>3.25c</td>
<td>200 F</td>
<td>3.33d</td>
</tr>
<tr>
<td>salt, glucose</td>
<td>3.67d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phosph. glucose</td>
<td>4.78e</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aConsumer panel: 1=like extremely, 9=dislike extremely.

bHB = Hot-boned, CB = Conventionally boned.

cdeMean values in the same column with common superscripts are not different (P>.05).
Figure 24.1. Effects of ingredient and internal cooking temperature treatments on "warmed-over flavor" scores of restructured beef roasts. SPG = salt, phosphate and glucose; SP = salt and phosphate; SG = salt and glucose; PG = phosphate and glucose.

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"Restructuring" is a process by which lower value meat raw material, which is generally merchandized in the ground form, is manufactured into "value added" products. The process consists of chopping the meat, mixing it to bring its binding proteins to the surface, blending in desired amounts of fat and added ingredients, and forming the final mixture into appropriate shapes. The product can be raw or precooked, and can be handled and distributed at either chilled or frozen temperatures. The advantage of this process is that it can produce a product that is consistent in quality, composition, size and price; a very desirable advantage for those supplying the needs of the food service industry.

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