COMPARISON OF HOT-BONED AND COLD-BONED MEAT FOR
PREPARATION OF PRE-COOKED ROAST BEEF

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SUMMARY

Two methods for preparing pre-cooked roast beef were compared relative
to their effects on cooking, storage and tenderness characteristics of top
round roasts. For the first method, carcasses were chilled conventionally
and the top rounds were removed (cold-boned) for cooking. In the second
method of preparation, the top rounds were removed from the carcasses
immediately after slaughter (hot-boned) and the cooking procedures initiated.
Hot-boned roasts required less cooking time per unit weight and were not
different in cooking loss from the cold-boned roasts. Method of roast pre-
paration or electrical stimulation of the carcass prior to roast removal
did not influence roast palatability. Hot-boning followed by cooking of
the meat appears to offer advantages from the standpoint of energy savings,
without detrimentally affecting quality.

INTRODUCTION

Production of pre-cooked roast beef for use by institutions and delica-
tessen has increased tremendously in the past five years. Most processing
systems involve the cooking of chilled roast either in water or smokehouses.
Both systems require large expenditures of energy since the meat is chilled
first on the carcass, removed, heated during cooking and then chilled again.
Tremendous energy savings could be realized by removing the roast soon after
slaughter while it is near body temperature (95-100°F), cooking it immediately
and then chilling the cooked roast. Several studies have indicated that the
palatability of meat removed from the carcass soon after slaughter may be
unacceptable, particularly from the tenderness standpoint. However, the
combination of electrical stimulation of the carcass and rapid cooking may
alleviate the tenderness problem and capitalize on the energy savings.

OBJECTIVE

To determine the cooking characteristics, storage stability and palat-
ability of top round roast that had been removed from either hot or chilled
carcasses (electrically stimulated or untreated during the slaughter process)
and cooked immediately.

PROCEDURE

Ten Standard grade heifers were slaughtered and the 20 sides allotted
to one of four treatments. The treatments were: (1) C - no electrical
stimulation and normal chill; (2) ES+G - electrical stimulation and normal chill; (3) HB - no electrical stimulation and hot-boned; and, (4) ES+HB - electrical stimulation and hot-boned. The electrical stimulation treatment (ES) was 500 volts (AC) administered in one-second impulses for a total of one minute (approximately 60 impulses). The hot-boning procedure (HB) involved removal of the top round roasts from appropriate sides at one hour after initiation of the slaughter process. The top round roasts were removed from the chilled carcasses (C) at 24 hours postmortem.

For cooking, all roasts were fitted with thermocouples for internal temperature monitoring, placed in special plastic cooking bags, vacuumized and cooked in a 135°F water bath until an internal temperature of 135°F was reached and held at this temperature for 30 minutes. This cooking procedure follows the USDA guidelines for pre-cooked roast and insures adequate bacterial destruction without exceeding a rare degree of doneness. Immediately upon removal from the cooking tank, all roasts were chilled rapidly to 34°F in a slush ice bath.

The chilled roasts were removed from the cooking bags and cut into halves. One portion was frozen immediately. The remaining portion was vacuumed-packaged, stored for 30 days at 34°F, repackaged in retail packaging material and placed in a retail case for 2 days.

Palatability samples were obtained from both frozen and vacuum stored roast. Tenderness was evaluated by removing one-half inch cores and shearing these cores on the Warner-Batzlizer shear device. Shear force values that exceed 12 pounds are considered tough; those below 12 pounds are tender.

RESULTS AND DISCUSSION

The average values for cooking characteristics, storage loss and tenderness are presented in Table 1. Roasts cooked from the hot state (HB and ES+HB) required less cooking time per pound of meat. This was expected since the temperature rise during cooking for these roasts was approximately 35 degrees (100°F to 135°F) as compared to a 93 degree temperature rise (42°F to 135°F) required for the chilled roasts. This reduced cooking time should result in a significant energy savings. This savings should be realized by the need to chill only the trimmed, cooked roast that has lost 4-5% during cooking rather than the large carcass, 25% of which is waste fat and bone.

Cooking loss percentages were comparable for all treatments. These low values, less than 5%, reflect the advantages of using a low cooking temperature (135°F). Higher cooking temperatures result in appreciably greater cooking losses. In addition to reduced cooking losses, low cooking temperatures produce more uniformly rare roasts.

During vacuum storage at 34°F for 30 days, the hot-boned, unstimulated roast (HB) lost less juice than did the stimulated, cold-boned roasts. All of these storage loss values are quite high due principally to the large cut surface areas. Loss from intact roasts should only be 1 to 2% during storage. Microbial counts on the roast were equivalent before and after cooking. However, the hot-boned roasts had higher microbial numbers after the storage period.
Neither electrical stimulation of the carcass nor hot boning had a significant effect on roast tenderness (table 1). The inside muscle that makes up a portion of the top round appeared to be more tender than the outside muscle. A comparison of shear values for roasts frozen immediately after cooking and chilling with shear values for roasts stored in vacuum package for 30 days was not conducted since the use of different muscle areas precluded such.

This experiment suggests that the energy savings associated with cooking beef roast from the hot state rather than chilling the carcass first may be achieved without detrimental effects on meat tenderness. Electrical stimulation of the carcass prior to roast removal did not alter the tenderness.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Treatment</th>
<th>C</th>
<th>ES+C</th>
<th>HB</th>
<th>ES+HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking time, min/lb</td>
<td></td>
<td>51.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>49.5&lt;sup&gt;d&lt;/sup&gt;</td>
<td>41.4&lt;sup&gt;e&lt;/sup&gt;</td>
<td>41.6&lt;sup&gt;e&lt;/sup&gt;</td>
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<tr>
<td>Cooking loss, %&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>4.7&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4.7&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Storage loss, %</td>
<td></td>
<td>5.6&lt;sup&gt;de&lt;/sup&gt;</td>
<td>7.3&lt;sup&gt;e&lt;/sup&gt;</td>
<td>4.8&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6.6&lt;sup&gt;de&lt;/sup&gt;</td>
</tr>
<tr>
<td>W-B shear force, lb&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Frozen storage</td>
<td>8.3&lt;sup&gt;d&lt;/sup&gt;</td>
<td>8.9&lt;sup&gt;d&lt;/sup&gt;</td>
<td>10.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>10.0&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Inside muscle</td>
<td>13.8&lt;sup&gt;d&lt;/sup&gt;</td>
<td>11.6&lt;sup&gt;d&lt;/sup&gt;</td>
<td>13.1&lt;sup&gt;d&lt;/sup&gt;</td>
<td>12.5&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Outside muscle</td>
<td>8.6&lt;sup&gt;d&lt;/sup&gt;</td>
<td>8.6&lt;sup&gt;d&lt;/sup&gt;</td>
<td>8.2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>9.0&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Vacuum storage</td>
<td>14.9&lt;sup&gt;d&lt;/sup&gt;</td>
<td>15.2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>14.1&lt;sup&gt;d&lt;/sup&gt;</td>
<td>13.6&lt;sup&gt;d&lt;/sup&gt;</td>
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</table>

<sup>a</sup> Treatments were: C = no stimulation, cold-boned; ES+C = electrical stimulation, cold-boned; HB = no stimulation, hot-boned; and, ES+HB = stimulation, hot-boned.

<sup>b</sup> Storage loss is the loss of juices during vacuum storage. This material accumulates in the bag and is called purge.

<sup>c</sup> Values that exceed 12 pounds are considered tough.

<sup>de</sup> Values in the same row with different superscripts are significantly different (P<.05).