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Abstract
Eighty-one boneless pork loins were used to determine the influence of freezing and pH on Warner-Bratzler shear force (WBS) values and cookery traits. Chops with lower pH (<5.5 to 5.5) had higher cooking losses than chops with intermediate pH (5.7 to 5.9) and higher pH (6.0 to >6.2). Similar to cooking losses, total moisture losses decreased with increased pH. Frozen chops had lower WBS values (more tender) than fresh chops. However, fresh chops had a higher total yield (lower moisture loss) than frozen chops.; Swine Day, Manhattan, KS, November 16, 2000

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EFFECTS OF FREEZING PORK CHOPS ON WARNER-BRATZLER SHEAR FORCE AND COOKERY TRAITS

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Summary

Eighty-one boneless pork loins were used to determine the influence of freezing and pH on Warner-Bratzler shear force (WBS) values and cookery traits. Chops with lower pH (<5.5 to 5.5) had higher cooking losses than chops with intermediate pH (5.7 to 5.9) and higher pH (6.0 to >6.2). Similar to cooking losses, total moisture losses decreased with increased pH. Frozen chops had lower WBS values (more tender) than fresh chops. However, fresh chops had a higher total yield (lower moisture loss) than frozen chops.

(Key Words: Pork, Quality, Freezing.)

Introduction

One of the many concerns of the meat industry is extending shelf life of a product for prolonged shipment or storage. More than 80% of fresh pork produced in the U.S. is shipped overseas, and this prolonged storage has the potential of causing spoilage, making the product unsaleable. Therefore, an effective method to preserve quality characteristics is needed. Freezing pork loins can be an alternative to sending a fresh product. Freezing has been shown to prevent microbial growth. In addition, freezing temperature for the correct amount of time also can destroy *Trichinella spiralis*, a major parasite found in pork. However, freezing of pork may have adverse effects on tenderness and moisture loss.

Procedures

Eighty-one boneless pork loins were obtained from a commercial packing facility utilizing pH as the selection criterion. A pH probe designed specifically for Farmland Industries (Cypress, Lawrence, KS) was inserted on the bone side, 10 in. from the anterior end of the pork loin. Loins were placed into vacuum bags (CRYOVAC, Duncan, SC) and vacuum packaged (Target 4 Torr, Model 14EL, CRYOVAC, Duncan, SC). After packaging, loins were run through a shrink tunnel (198° to 202°F) and aged for 14 d at 31°F in Farmland's warehouse. Loins then were transported to Kansas State University, where they were stored for 30 d at 31°F. At 44-d postmortem, loins were weighed, removed from the vacuum bags, and cut into 1-in. chops.

Chops at 10 and 11 in., anterior to posterior, were used to determine package, cooking, and total percentage moisture losses as well as Warner-Bratzler shear force values (WBS). Chops taken at 10 in. were vacuum packaged (CRYOVAC, Duncan, SC); frozen; and stored at -40°F until WBS evaluation. Vacuum seals were broken, and chops were thawed for 24 h at 37°F. Chops were weighed in the bag prior to thawing and weighed again out of the bag after thawing.

Chops taken at 11-in. were weighed, covered with a polyvinyl chloride wrap in 2S Styrofoam trays, and weighed for moisture loss calculations. Each chop was placed into an open-top retail display case for 24 h at 32°F. Chops then were removed from the case and weighed for further calculations of moisture loss.

All chops were cooked to an internal temperature of 160°F in a Blodgett dual-air-flow oven (DFG-201, G.S., Blodgett Co., Inc., Burlington, VT). Temperature was monitored using a thermocouple attached to a Doric Minitrend 205 temperature recorder (Emmerson Electric S.A., Doric Div., San

Diego, CA.). Chops then were cooled for 1 h and weighed again. They were chilled for 24 h at 38°F before six 0.5-in. cores were taken parallel to the muscle fibers and sheared perpendicular to the muscle fibers using a WBS apparatus attached to a Universal Instron testing machine (Model 4201, Instron, Canton, MA).

Percentages of thawing and cooking losses were calculated by the equations [(frozen wt.-thawed wt.)/frozen wt.] and [(raw wt. -cooked wt.)/raw wt.], respectively. Total percentage moisture loss was calculated by the equation [1-((1-purge, %) × (1- thawing loss, %) × (1-cooking loss, %))].

Results and Discussion

Effects of pH on WBS values and percentage moisture loss are reported in Table 1. No differences (P>.05) were observed for WBS. However, percentage cooking losses decreased with increased loin pH. Cooking losses at pH >6.2 were over 7% less than those at pH <5.5. The decrease in cooking loss tended to become less as pH increased. Chops with a pH of <5.5 had higher (P<.05) cooking losses than chops with pHs of 5.8 to >6.2. However, chops with a pH of 5.8 had higher (P<.05) cooking losses than chops with a pH of >6.2. Percentage total moisture losses were similar to cooking losses and decreased with increased loin pH. Losses for chops with a pH of <5.5 were over 6% higher than those for chops with a pH of >6.2. Chops with a pH of <5.5 had higher (P<.05) total moisture losses than chops with pHs of 5.9 to >6.2. However, chops with a pH of 5.9 had similar (P>.05) losses to chops with a pH of >6.2.

The quality characteristics for fresh and frozen chops are presented in Table 2. Chops that were frozen had lower (P<.05; more tender) WBS values than chops that were fresh. No differences (P>.05) were found for percentage cooking losses between fresh and frozen chops. However, fresh chops had lower (P <.05) total percentage moisture losses than frozen chops.

This study suggests that pH and freezing affect storage and cooking yield as well as WBS values. Frozen chops will have lower WBS values (more tender) and a higher total percentage of moisture loss than fresh chops.

Table 1. Influence of pH on Fresh and Frozen Chops

	Loin pH									
Variable	<5.5	5.5	5.6	5.7	5.8	5.9	6.0	6.1	>6.2	SE
WBS, kg	2.75	2.93	2.41	2.09	2.53	2.43	2.84	2.42	2.58	0.2802
Cooking loss, %	25.82^{e}	24.65^{de}	23.61^{cde}	21.93^{abcd}	22.26^{bcd}	21.05^{abc}	18.80^{ab}	18.84^{ab}	18.70^{a}	1.29
Total loss, %	31.21^{e}	30.75^{de}	29.36^{cde}	27.20^{abcd}	27.76^{bcde}	24.43^{ab}	26.33^{abc}	23.87^{a}	24.53^{ab}	1.24

^{a,b,c,d,e}Means within a row with different superscript letter differ (P<.05).

Table 2. Warner-Bratzler Shear Force and Cookery Traits of Fresh and Frozen Chops

Variable	Frozen	Fresh	SE
WBS, kg	2.23^{a}	2.88^{b}	0.118
Cooking loss, %	21.57	21.9	1.29
Total loss, %	29.4^{b}	25.14^{a}	0.051

^{a,b}Means within a row with a different superscript letter differ (P<.05).