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Freezing Improves Instrumental Tenderness of Strip Steaks Purchased at Retail Grocery Stores

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Abstract
When meat is frozen cell membranes can be damaged, which may lead to lower water holding capacity and higher cooking losses. Several researchers have indicated that freezing *Longissimus* muscle (strip loin) steaks may lower Warner-Bratzler shear force, a measurement to objectively measure beef tenderness, compared with steaks not previously frozen. The objective of this study was to determine the effect of freezing on beef tenderness and cooking characteristics of strip steaks purchased from grocery store outlets.

Keywords
tenderness, retail, longissimus

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CATTLEMEN'S DAY 2016

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Introduction

When meat is frozen cell membranes can be damaged, which may lead to lower water holding capacity and higher cooking losses. Several researchers have indicated that freezing *Longissimus* muscle (strip loin) steaks may lower Warner-Bratzler shear force, a measurement to objectively measure beef tenderness, compared with steaks not previously frozen. The objective of this study was to determine the effect of freezing on beef tenderness and cooking characteristics of strip steaks purchased from grocery store outlets.

Key words: tenderness, retail, longissimus

Experimental Procedures

Packages (n=125) containing two strip steaks were purchased during different weeks between March 2014 to February 2015 from self-serve display cases in local grocery store outlets. Steak treatments included Premium Choice (modest marbling or higher), Choice, and non-grade specified steaks. One steak was randomly selected from each package and cooked the following day (fresh, non-frozen) while the other steak was vacuum-packaged and frozen at -4°F for two weeks. Marbling scores were taken prior to cooking for fresh (non-frozen) steaks and before freezing on steaks that were to be frozen. Frozen steaks were thawed for 24 hours prior to cooking. Fresh (non-frozen) and previously frozen steaks were cooked using a convection oven preheated to 325°F. Steak temperatures were monitored using thermocouples. Steaks were removed from the oven once they reached an internal temperature of 158°F. Cooking loss or weight lost during cooking, expressed as a percent of initial weight, and cooking time were measured before cooked steaks were refrigerated. The cooked steaks were then held at a refrigerated temperature for 12 hours prior to coring (8 cores per steak) and shearing using an Instron (Model 5569, Instron Corp., Norwood, MA) with a Warner-Bratzler shear force blade attachment (G-R Manufacturing Co., Manhattan, KS).

Results and Discussion

A greater ($P<0.05$) amount of marbling was observed for Premium Choice steaks than Choice steaks; and Choice steaks exhibited a greater ($P<0.05$) amount of marbling

than non-grade specified steaks (Table 1). Warner-Bratzler shear force values were lower (P<0.05) for Premium Choice steaks than non-grade specified and Choice steaks. Percentages of cooking loss were greater (P<0.05) for Choice and non-grade specified steaks than Premium Choice steaks. Cooking time was longer (P<0.05) for Choice steaks than Premium Choice and non-grade specified steaks.

Previously frozen steaks had (P<0.05) lower WBSF values (Figure 1), greater cooking losses, and longer cooking times than fresh steaks (Table 2). This study conducted on commercially available strip loin steaks purchased in retail stores had similar results compared to studies with a more controlled steak source. We speculate that the cell membrane damage due to freezing improves tenderness, but also results in more moisture loss during cooking.

Implications

Freezing strip steaks increases instrumental tenderness of strip steaks purchased from retail outlets, but also causes greater cooking losses and increases cooking time.

Table 1. Least squares means (SEM)[1] for steak type categories of strip steaks

Trait	Premium Choice (n=104)	Choice (n=42)	Non-grade specified (n=104)
Marbling score[2]	525[c] (8.3)	471[b] (13.0)	402[a] (8.3)
Cooking loss, %	21.5[a] (0.43)	23.6[b] (0.67)	23.2[b] (0.43)
Cooking time, min[3]	26.5[a] (0.63)	30.8[b] (0.99)	27.5[a] (0.63)
Warner-Bratzler shear force, lb	6.61[a] (0.17)	7.34[b] (0.27)	7.59[b] (0.17)

[1]SEM = standard error of the mean.
[2]Marbling score: 300 = Slight, 400 = Small, 500 = Modest.
[a,b,c] Means within a row with a different superscript are different (P<0.05).
[3] Cook time=minutes of cook time to reach an internal temperature of 158°F.

Table 2. Least squares means for condition categories of strip steaks

Trait	Fresh	Frozen	SEM[1]
Marbling score[2]	465[a]	467[a]	6.10
Cooking loss, %	21.83[a]	23.65[b]	0.43
Cooking time, min[3]	27.43[a]	29.15[b]	0.55

[1]SEM = standard error of the mean.
[2]Marbling score: 300 = Slight, 400 = Small, 500 = Modest.
[a,b] Means within a row with a different superscript are different (P<0.05).
[3] Cook time=minutes of cook time to reach an internal temperature of 158°F.

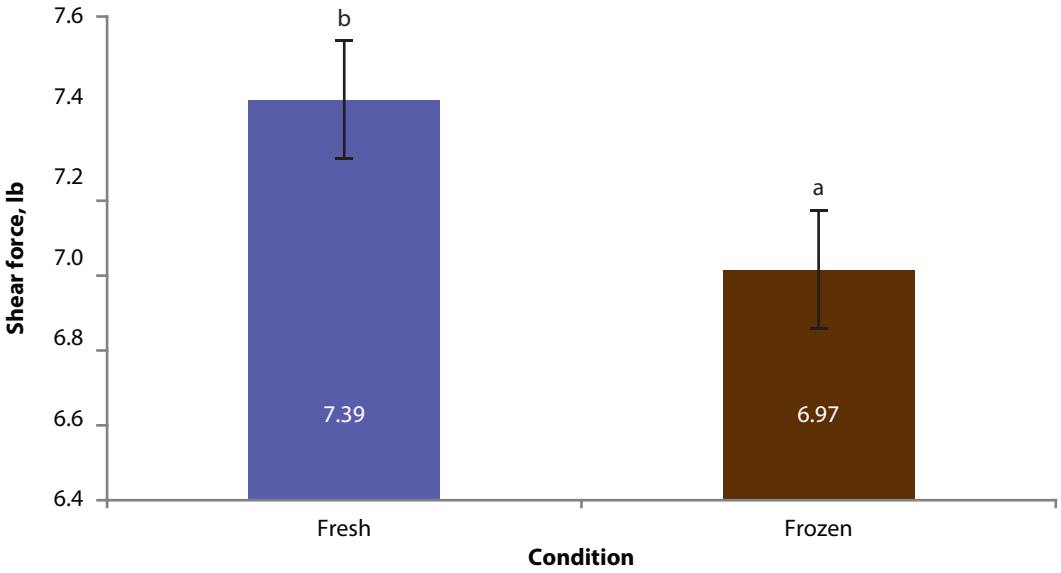

Figure 1. Warner-Bratzler shear force of fresh or previously frozen strip steaks cooked to an internal temperature of 158°F.

[a,b]Different letter indicates difference (P≤0.01).