Comparison of Cooking Yields and Fat and Moisture Retentions in Retail Beef Cuts

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Introduction

- ❑ The Nutrient Data Laboratory (NDL) at the USDA is tasked to obtain current representative beef data for consumer and research use.
- ❑ NDL recently conducted a nationwide Nutrient Data Improvement (NDI) study in collaboration with Colorado State University, Texas A&M University, and Texas Tech University and with support from National Cattlemen's Beef Association (NCBA), to determine the effects of cooking on factors such as cooking yields, retentions, and changes in nutrient content.
- ❑ Cooking yields describe changes in food weight due to moisture loss, water absorption, and/or net fat gains/losses during food preparation and cooking.
- ❑ True retention is defined as the measure of the proportion of the nutrient remaining in the cooked food in relation to the nutrient originally present in the raw food.
- ❑ Data results from NDL studies are developed through the Nutrient Databank System (NDBS), and released by the Nutrient Data Laboratory (NDL) as tables of Cooking Yields and Nutrient Retention Factors for foods.
- ❑ Tables of Cooking Yields and Nutrient Retention Factors provide researchers, nutrition professionals, and consumers with changes in cooking yield, fat and moisture levels and nutrient content remaining after cooking.

Objectives

- ❑ To determine fat and moisture content of cooked roast and steak cuts for calculating cooking yield, and fat and moisture change and retentions.
- ❑ To determine the effect of different cooking methods (roasted versus grilled) and cut size (roast versus steak) on cooking yield , and percentage of moisture and fat retained after cooking.
- ❑ To evaluate differences in fat change and moisture change after cooking roast and steak cuts using 2 cooking methods.

Figure 1: Cooking Yield of 4 pairs of cuts (Roasted Roasts vs Grilled Steaks)

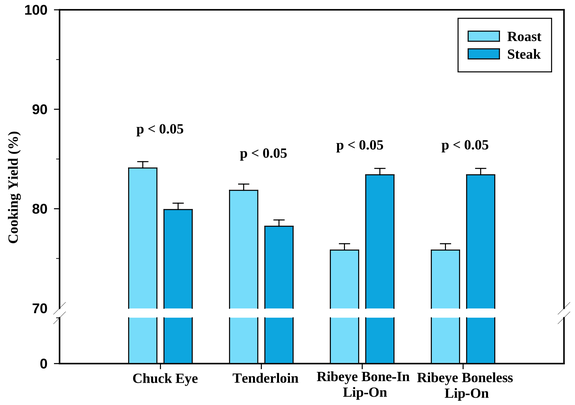

Figure 2: Percent Fat Change of 4 pairs of cuts (Roasted Roasts vs Grilled Steaks)

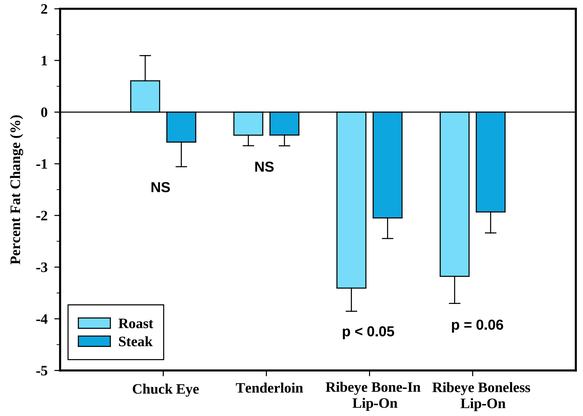

Figure 3: Percent Moisture Change of 4 pairs of cuts (Roasted Roasts vs Grilled Steaks)

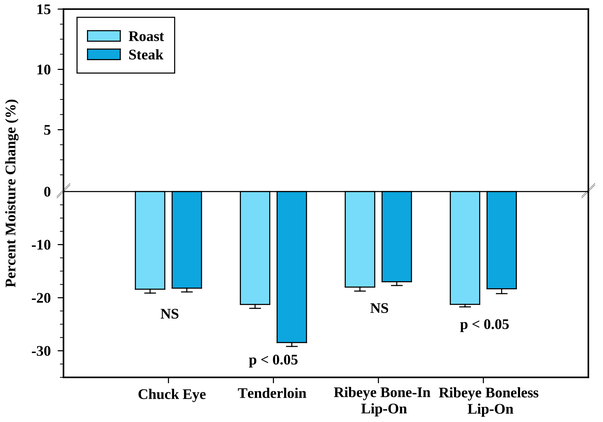

Table 1: Moisture and fat retentions for 4 pairs of roast and steak cuts

	% Moisture Retention (SE)	p values	% Fat Retention (SE)	p values
Chuck Eye Roast	79 (3.70)	0.24	130 (7.35)	0.78
Chuck Eye Steak	74 (2.07)		128 (3.78)	
Tenderloin Roast	77 (4.48)	0.29	121 (11.8)	0.62
Tenderloin Steak	70 (4.72)		133 (22.4)	
Ribeye Bone-in Lip-on Roast	63 (1.69)	< 0.05	116 (5.00)	0.27
Ribeye Bone-in Lip-on Steak	72 (1.31)		124 (6.38)	
Ribeye Boneless Lip-on Roast	64 (1.67)	< 0.05	121 (5.87)	0.65
Ribeye Boneless Lip-on Steak	72 (1.58)		117 (6.19)	

Methodology

- ❑ Up to 72 animals were obtained from six representative US locations using a statistical sampling plan so that samples represented quality grade, yield grade, genetic type, and gender proportions present in retail beef.
- ❑ Roast (2'' thick) and steak (1'' thick) samples from the chuck, rib, and loin were prepared from their respective primals.
- ❑ Roast cuts were roasted to internal temperature of 60°C using a non-commercial oven and steaks were grilled to 70°C internal temperature using a two-sided electric grill.
- ❑ Four pairs of cuts (n = 36 animals per cut) including chuck eye, tenderloin, ribeye bone-in lip-on, and ribeye boneless lip-on were analyzed at qualified laboratories.
- ❑ Analytical data for raw and cooked weights and proximates were processed through the Nutrient Data Bank System to obtain values for cooking yield, fat and moisture retention, and fat and moisture change.
- ❑ Analytical quality control was assured by using standard reference materials and in-house control materials.
- ❑ Paired comparisons were analyzed by multi-way mixed model analysis of variance to test for cut differences within cooking method in cooking yields, fat and moisture change, and fat and moisture retention. Critical value for p is 0.05.

References

- ❑ Martin J.N, Brooks J.C, Thompson L.D, Savell J.W, Harris K.B, May L.L, Haneklaus A.N, Schutz J.L, Belk K.E, Woerner D.R, Legako J.F, Luna A.M, Douglass L.W, Douglass S.E, Howe J., Duvall M., Patterson K.Y, and Leheska J.L. (2013). Nutrient database improvement project: The influence of U.S.D.A. quality and yield grade on the separable components and proximate composition of raw and cooked retail cuts from the beef rib and plate. Meat Science 95: 486-494.
- ❑ Murphy E.W, Criner P.E, and Gray B.C. (1975). Comparison of methods for determining retentions of nutrients in cooked foods. Journal of Food Composition and Analysis 16: 331-341.

Calculations

- ❑ Cooking yields were calculated using the following formula

$$Yield\ \% = \frac{cooked\ sample\ ckd\ weight}{cooked\ sample\ raw\ weight} \times 100$$

- ❑ Percent moisture and fat change were calculated using the following formula, where EP is edible portion

$$\frac{[\frac{g\ water\ ckd\ EP}{100\ g\ ckd\ EP} \times g\ ckd\ EP] - [\frac{g\ water\ raw\ EP}{100\ g\ raw\ EP} \times g\ raw\ EP]}{g\ raw\ cut\ as\ marketed}$$

- ❑ Moisture and fat retention were calculated using the following formula

$$[\frac{Nutrient\ content\ of\ ckd\ sample\ x\ Cooked\ sample\ ckd\ weight}{Nutrient\ content\ of\ raw\ sample\ x\ Cooked\ sample\ raw\ weight}] \times \frac{Raw\ sample\ raw\ weight}{Ckd\ sample\ raw\ weight} \times 100$$

Results

- ❑ Chuck and tenderloin roasts had higher cooking yields ($p < 0.05$) and retained more moisture compared to respective steaks. (Figure 1 and Table 1)
- ❑ Ribeye bone-in lip-on and ribeye boneless lip-on roasts had lower cooking yield (77% and 76%) and retained less moisture (63% and 64%) than the respective steaks with 85% and 83% cooking yield and 72% moisture retention ($p < 0.05$). (Figure 1 and Table 1)
- ❑ Fat retention in tenderloin steak and ribeye bone-in steak were higher than in the respective roasts (NS).(Table 1)
- ❑ Fat change varied among cuts and size of cuts. The difference was significant only between the ribeye bone-in lip-on roast and steak pair ($p < 0.05$). (Figure 2)
- ❑ Moisture loss occurred in all 4 pairs of cuts ($p < 0.05$ for tenderloin and ribeye boneless roast and steak pairs) (Figure 3)

Conclusion

- ❑ Cooking yield data including amount of fat and moisture retained and amount of fat and moisture changes after cooking provide researchers, nutritionists, and consumers at retail level with valuable data for selection and cooking of retail cuts.
- ❑ USDA tables of Cooking Yields for Meat and Poultry and for Nutrient Retention Factors are available at http://www.ars.usda.gov/ba/bhnrc/ndl.

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