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Consumer Evaluation of the Degree of Doneness of Beef Strip Loin Steaks Cooked to Six End-Point Temperatures

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Abstract

Objective: The objective of this study was to assess consumers' degree of doneness practices in addition to their ability to identify beef steak degrees of doneness.

Study Description: Beef strip loins (n = 24) from 12 animals representing five quality treatments [Prime, Top Choice, Low Choice, Select, and Select Enhanced (108%)] were collected. Steaks were cooked to an end-point temperature of very-rare (130°F), rare (140°F), medium-rare (145°F), medium (160°F), well-done (170°F), or very well-done (180°F). Cooked steaks were cut in half, perpendicular to the long axis of the steak, and photographs were taken immediately on the internal face of the lateral side. A digital survey for consumers was developed for electronic evaluation of the cooked steak images. Consumers (n = 1,134) answered a demographics questionnaire, followed by questions pertaining to temperature and determining degree of doneness. Next, 10 steak images depicting varying degrees of doneness were randomly selected by Qualtrics Software for each consumer to identify the degree of doneness of the steak pictured.

The Bottom Line: Consumers do not have a good understanding of beef degrees of doneness, and are unable to consistently and accurately identify degrees of doneness of steaks cooked to specified end-point temperatures. This can create challenges when consumers communicate their degree of doneness preferences at foodservice establishments.

Keywords

consumer, degree of doneness, temperature

Authors

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K-STATE Research and Extension

CATTLEMEN'S DAY 2019

Consumer Evaluation of the Degree of Doneness of Beef Strip Loin Steaks Cooked to Six End-Point Temperatures

L.L. Prill, L.N. Drey, J.L. Vipham, M.D. Chao, J.M. Gonzalez, T.A. Houser, E.A.E. Boyle, and T.G. O'Quinn

Abstract

The objective of this study was to assess consumers' degree of doneness practices in addition to their ability to identify beef steak degrees of doneness. Beef strip loins (n = 24) were collected from 12 animals representing five quality treatments [Prime, Top Choice, Low Choice, Select, and Select Enhanced (108%)]. Steaks were cooked to an end-point temperature of very-rare (130°F), rare (140°F), medium-rare (145°F), medium (160°F), well-done (170°F), or very well-done (180°F). Each cooked steak was cut in half, perpendicular to the long axis of the steak, and photographs were taken immediately of the internal face of the lateral side. A digital survey was developed for consumers to evaluate the cooked steak images. Of the 1,134 respondents, 27.3 to 35.1% of consumers correctly categorized steaks for the appropriate degree of doneness. Medium-rare was reported by 41% of consumers as their preferred degree of doneness and only 16% of consumers reported using temperature or a food thermometer for determining degree of doneness when cooking beef. Consumers do not have a good understanding of beef degrees of doneness, and are unable to consistently and accurately identify degrees of doneness of steaks cooked to specified end-point temperatures.

Introduction

Degree of doneness is important to achieving optimal palatability of beef (Lorenzen et al., 1999; Lucherk et al., 2016). Additionally, consumers' perception of the degree of doneness of the steak they are served can influence eating satisfaction (Cox et al., 1997; Schmidt et al., 2002). The objective of this study was to assess consumers' degree of doneness cooking practices in addition to their ability to identify steak degrees of doneness.

Experimental Procedures

Beef strip loins [n = 24, Institutional Meat Purchasing Specifications #180; (North American Meat Institute, 2014)] from 12 animals representing four quality grades [Prime, Top Choice (Modest^{00} – Moderate^{100} marbling), Low Choice (Small^{00} – Small^{100} marbling), and Select] were collected from a Midwest beef processor and transported to the Kansas State University Meat Laboratory. Additional Select loins

were collected and designated for enhancement with water, salt, and alkaline phosphate to 108% of raw weight. Procedures described by Drey (2018) were used for sub-primal fabrication, enhancement, and steak allocation. All steaks were vacuum packaged and stored at -40°F until further analysis.

Steaks were cooked on clam-style grills (Griddler; Cuisinart, Stamford, CT) set to a surface temperature of 350°F. A probe thermometer (Super-Fast Thermopen; ThermoWorks, American Fork, UT) was inserted into the geometric center of each steak and remained in place during the cooking process. Steaks were removed following cooking so that the peak end-point temperature was very-rare (130°F), rare (140°F), medium-rare (145°F), medium (160°F), well-done (170°F), or very well-done (180°F) (NCBA, 2008; American Meat Science Association, 2015). Cooked steaks were cut in half, perpendicular to the long axis of the steak, and photographs (n = 357) were taken immediately using a digital camera (Canon PowerShot SX620 HS) of the internal face of the lateral side. A digital survey for consumers was developed for electronic evaluation (Qualtrics Software, Provo, UT). Consumers (n = 1,134) answered a demographics questionnaire, followed by questions pertaining to temperature and determining degree of doneness. Finally, 10 steak images depicting six degrees of doneness were randomly selected by Qualtrics Software for each consumer to identify the degree of doneness of the steak pictured. Statistical analysis was conducted in SAS (Version 9.4, SAS Inst. Inc., Cary, NC) using PROC GLIMMIX with $\alpha = 0.05$. Data were analyzed using a completely randomized design.

Results and Discussion

There were no quality treatment effects ($P > 0.11$) for any degree of doneness of the pictures evaluated. Of the 1,134 respondents, 27.3 to 35.1% of consumers correctly categorized steaks as the appropriate degree of doneness (Figure 1). For all degrees of doneness, 16.4 to 35.6% of consumers identified steaks as two or more degrees of doneness higher or lower than the actual degree of doneness shown in the picture.

Medium-rare was identified as the preferred degree of doneness for beef steaks by 41% of consumers, followed by 23% preferring steaks cooked to medium (Figure 2). Previous studies found 61 to 70% of consumers preferred beef steaks cooked to at least a medium degree of doneness (Branson et al., 1986; Schmidt et al., 2002; Reicks et al., 2011). Our study found when in a restaurant setting, 59.9% of consumers determined degree of doneness after the first cut into the steak, while 18.7% of consumers determined the degree of doneness on the first bite (Figure 3).

When consumers were asked how they determined degree of doneness when cooking beef at home, 54% reported they used color, 15.7% used feel or firmness, and 10.4% used time (Figure 4). Additionally, 2.5% of consumers responded that they do not determine degree of doneness and 1.6% had another response. Responses for the other category included luck, juice, and fat texture.

Only 16% of consumers reported using temperature or a food thermometer for accurately determining the degree of doneness when cooking beef. As a follow-up question to those consumers that reported using temperature or a thermometer, 69% conveyed that the temperature they use is correlated to the temperature when a steak is pulled off

the heat. The remaining 31% said the temperature correlates to post-cooking temperature rise or carry-over cooking. Of the consumers that stated they use a carry-over temperature, 61% then reported that they did not know the temperatures that corresponded with each degree of doneness. For carry-over cooking temperatures, 40.8% of consumers reported using 136 to 145°F to correspond to a rare degree of doneness, while 20% reported that 166 to 175°F corresponded to a well-done degree of doneness. Likewise, within consumers that stated they relied on pull-off the heat temperatures, 47.6% were unaware of specific temperatures. Of the consumers that reported a temperature, 27.6% reported using a temperature less than 120°F to correspond to a rare degree of doneness, while 51.5% reported using 156 to 165°F to determine well-done pull-off temperature.

Implications

Consumers do not have a good understanding of beef degrees of doneness, and are unable to consistently and accurately identify degrees of doneness of steaks cooked to specified end-point temperatures. This can create challenges when consumers communicate their degree of doneness preferences at foodservice establishments.

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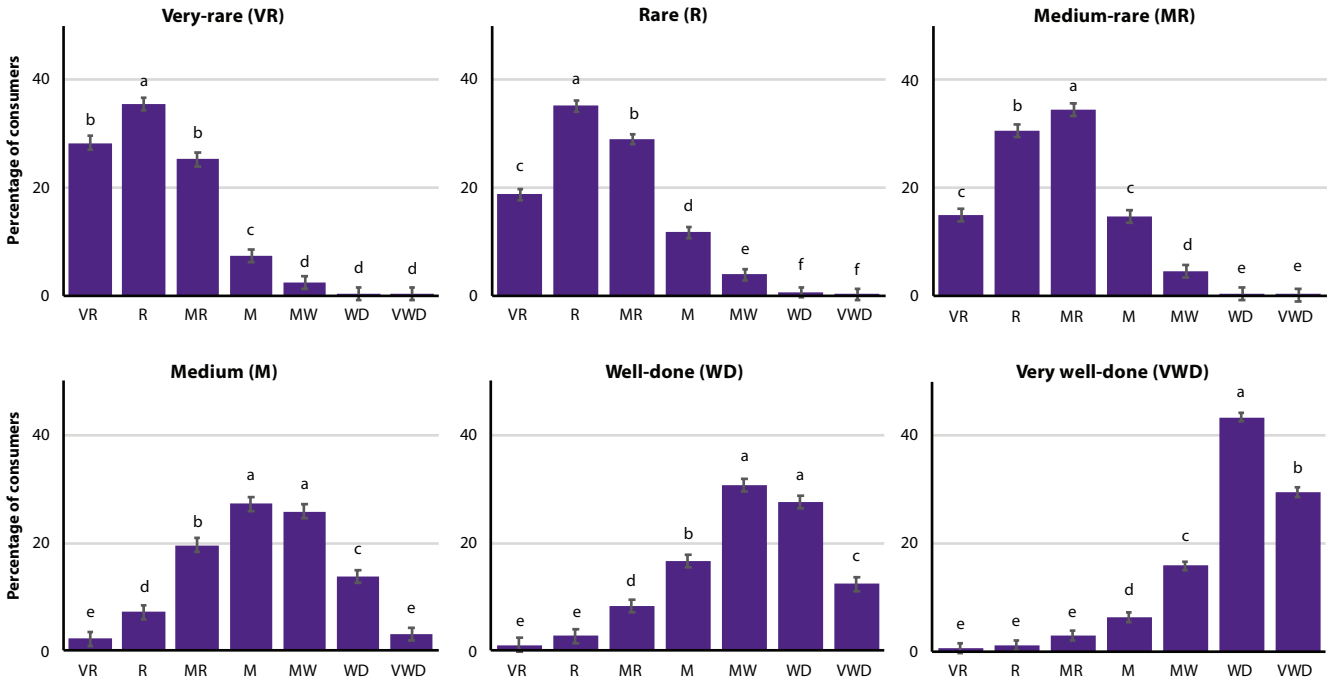

Figure 1. Percentage of consumers that correctly identified the represented degree of doneness on photographs of cooked beef strip loin steaks.

[abcde]Means within a degree of doneness without a common superscript differ ($P < 0.05$).

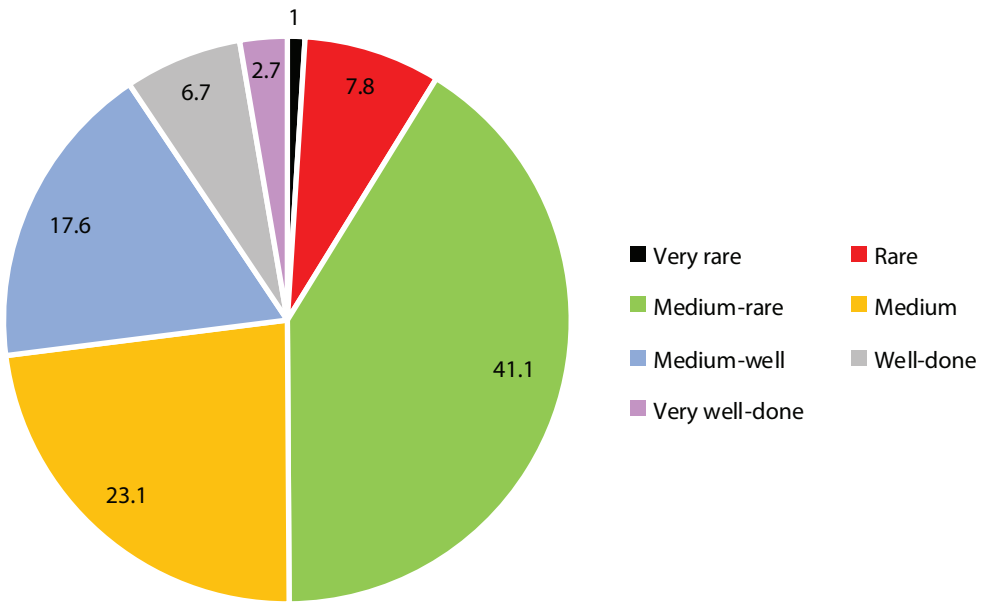

Figure 2. Consumers' (n = 1,134) preferred degree of doneness of beef steaks.

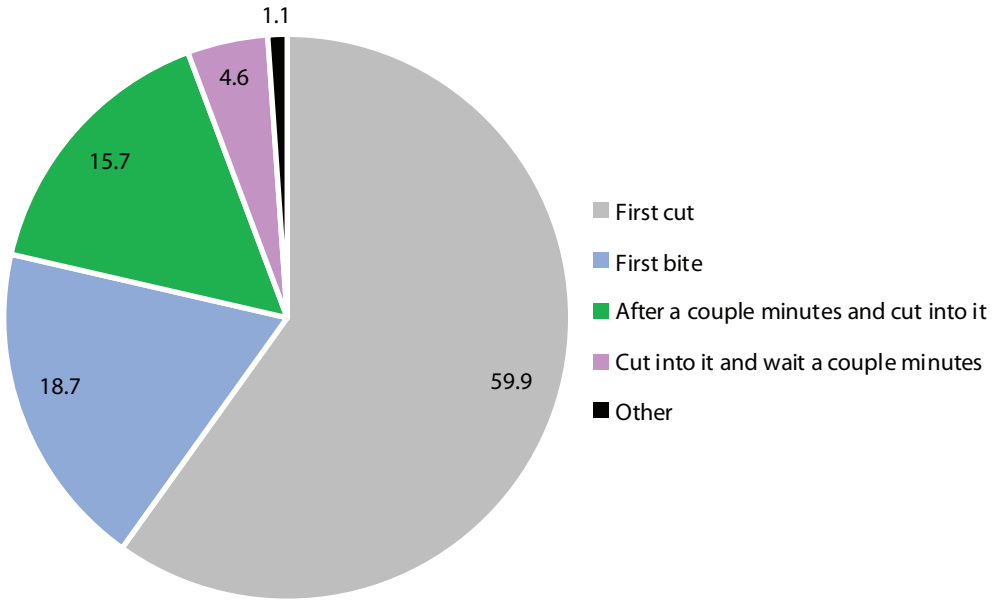

Figure 3. Consumers' (n = 1,134) method of determining degree of doneness of beef steaks in a restaurant.

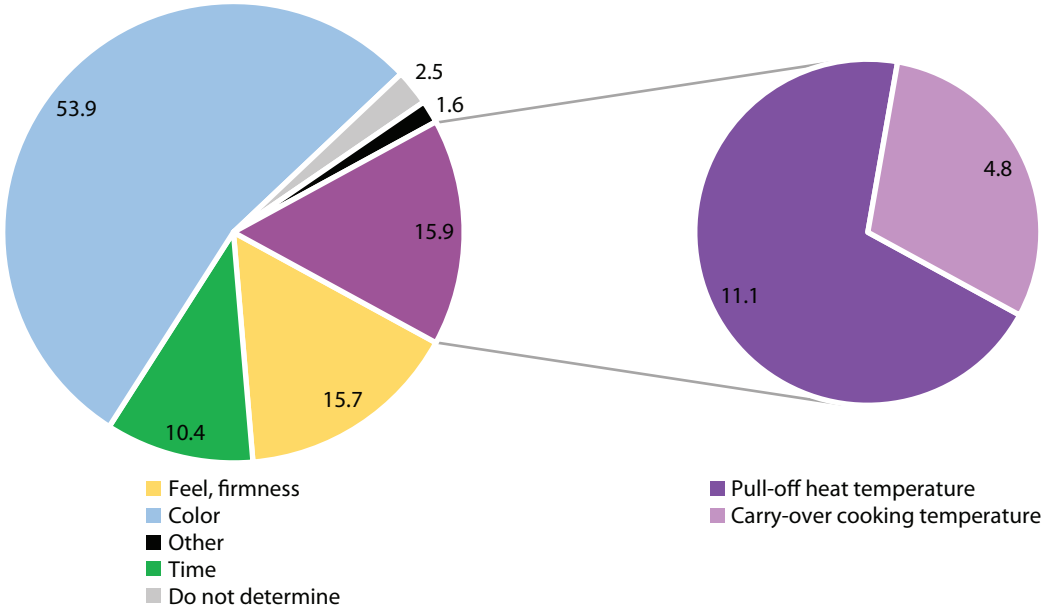

Figure 4. Consumers' (n = 1,134) method of determining degree of doneness while cooking beef.