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Abstract

Foodservice steak preparation practices and chefs' abilities to identify degrees of doneness were assessed. Beef strip loins ($n = 24$) were collected from 12 animals representing five quality treatments (Prime, Top Choice, Low Choice, Select, and Select Enhanced). 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 chefs to evaluate the cooked steak images. Chefs were recruited via email from around the U.S. using an established database of chefs from all segments of the industry. Of the 83 respondents, 66% of chefs reported using feel or firmness for degree of doneness determination, whereas 28% stated they use a thermometer. The degree of doneness for which a steak was cooked was correctly categorized by 13.6 to 44.2% of chefs. Chefs did not report they use end-point temperatures consistent with currently published recommendations. Additionally, chefs commonly rated steaks one degree of doneness above the degree of doneness category commonly associated with the end-point temperature.

Introduction

Previous literature has defined the importance of degree of doneness on consumer palatability ratings (Lorenzen et al., 2005; Lucherker et al., 2016). Preparation of steaks by foodservice chefs provides a critical link between the beef industry and consumers. To our knowledge, little published research exists evaluating chefs' cooking methods and thermometer use to assess degree of doneness of cooked beef steaks. The objective of this study was to assess foodservice steak preparation practices and chefs' abilities to identify 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 (Modest⁰⁰–Moderate¹⁰⁰ marbling), Low Choice (Small⁰⁰–Small¹⁰⁰

marbling), and Select] were collected from a Midwest beef processor and transported to the Kansas State University Meat Laboratory. Strip loins from an additional 12 Select grade animals 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, Thermo-Works, 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). Steaks rested for 3 minutes before being cut for evaluation. Cooked steaks were cut in half, perpendicular to the long axis of the steak, and photographs ($n = 357$; Figure 1) were taken immediately using a digital camera (Canon PowerShot SX620 HS) of the internal face of the lateral side. A digital survey (Qualtrics Software, Provo, UT) for chefs was made for the electronic evaluation of the cooked steak images. The survey included questions on demographics, determination on the degree of doneness, how temperature is measured, and what consumers typically order. Additionally, chefs were asked to assess the degree of doneness of 30 digital images representing multiple degrees of doneness. Chefs ($n = 83$) were recruited via email from around the U.S. using an established database of chefs from all segments of the industry. 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

Survey results showed that the chefs who responded to the survey were evenly dispersed across the U.S. When chefs were asked what type of establishment they associated with, 18.1% were in independent restaurants, 13.3% in casual dining, 13.3% with distributors, and 12.1% with fine dining. Of the 83 chefs respondents, 60% reported their education as formal culinary school, while 25% was informal, on the job training. Additionally, 69% reported most commonly working with a Premium Choice beef product.

To assess steak degree of doneness, 66% of chefs reported using feel or firmness (Figure 2), whereas 28% stated they use a thermometer. Within the chefs that reported use of thermometers, 14.5% indicated the specific temperature they used was pull-off the heat temperature and 13.3% used carry-over cooking temperature. Of the chefs that reported using carry-over temperature, 63.6% used a temperature of less than 120°F for rare, whereas 36.4% of chefs that reported pull-off temperatures described rare being less than 120°F. Of the chefs using carry-over temperature, 54.6% reported a well-done steak corresponded to a final temperature of 156 to 160°F. Additionally, only 1% of chefs reported determining degree of doneness using color.

There were no quality treatment effects ($P > 0.05$) for any degrees of doneness for the images evaluated. Between 13.6 and 44.2% of chefs correctly categorized steak images for the degree of doneness to which it was cooked (Figure 3). For all degrees of done-

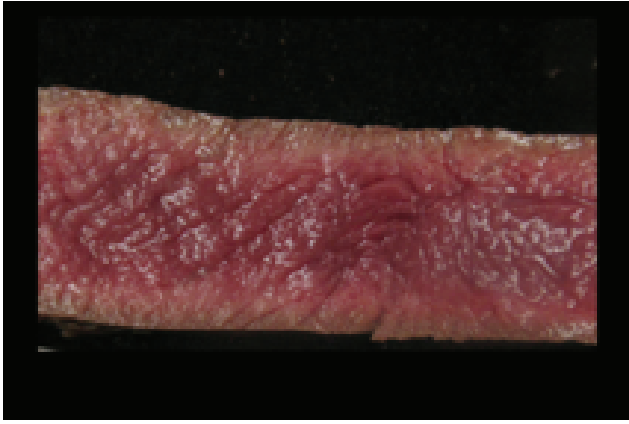
ness, 9.0 to 47.5% of chefs classified the steak images as two or more degrees of doneness from what the steak was actually cooked. Previously, Lehmuller and Hunt (2000) reported that chefs had difficulty correctly identifying steaks cooked to a medium degree of doneness, commonly identifying them as underdone; however, in our study, a greater ($P < 0.05$) number of chefs classified steaks cooked to rare as medium-rare and steaks cooked to medium as medium-well.

Implications

Chefs do not consistently use the same method when determining degrees of doneness and are unable to consistently or accurately identify degrees of doneness of steaks cooked to specified end-point temperatures. This can create challenges for foodservice establishments to deliver consumer degree of doneness preferences.

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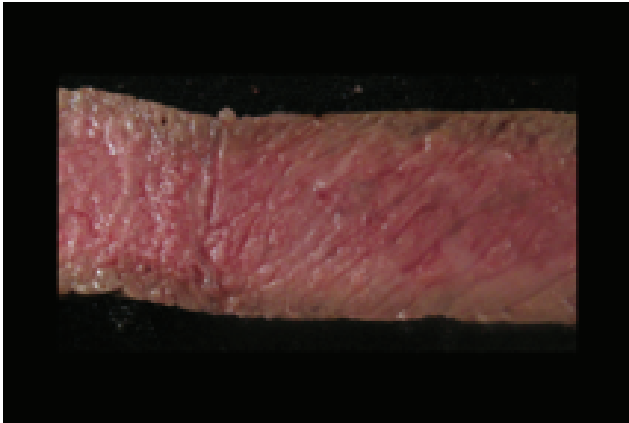
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Very rare 130°F



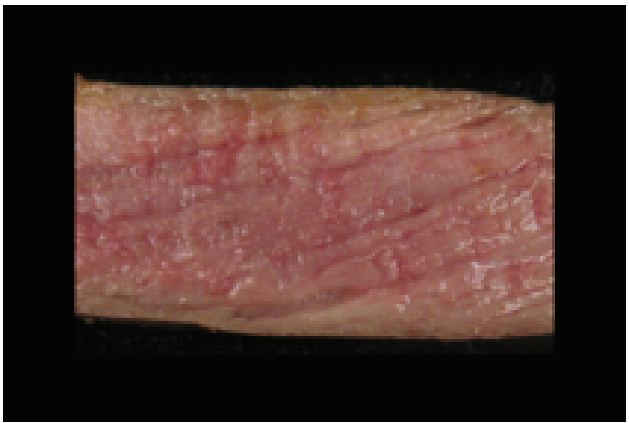
Medium 160°F



Rare 140°F



Well-done 170°F



Medium-rare 145°F



Very well-done 180°F

Figure 1. Beef steak degree of doneness.

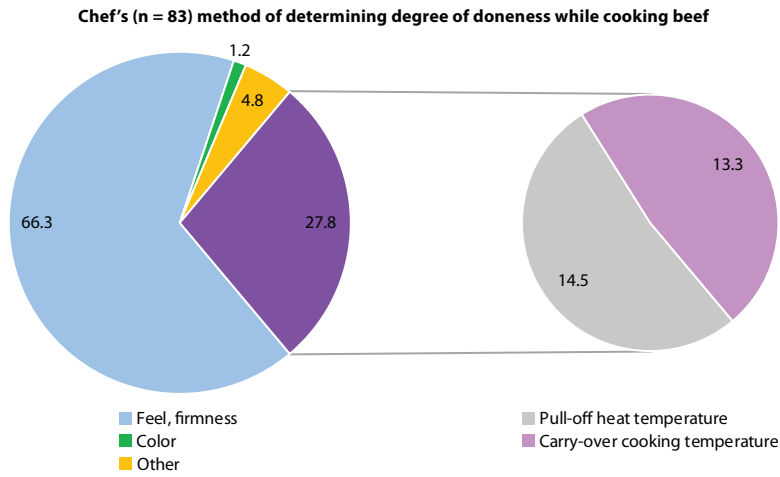


Figure 2. Percentage of chefs that use certain methods of determining degree of doneness while cooking beef.

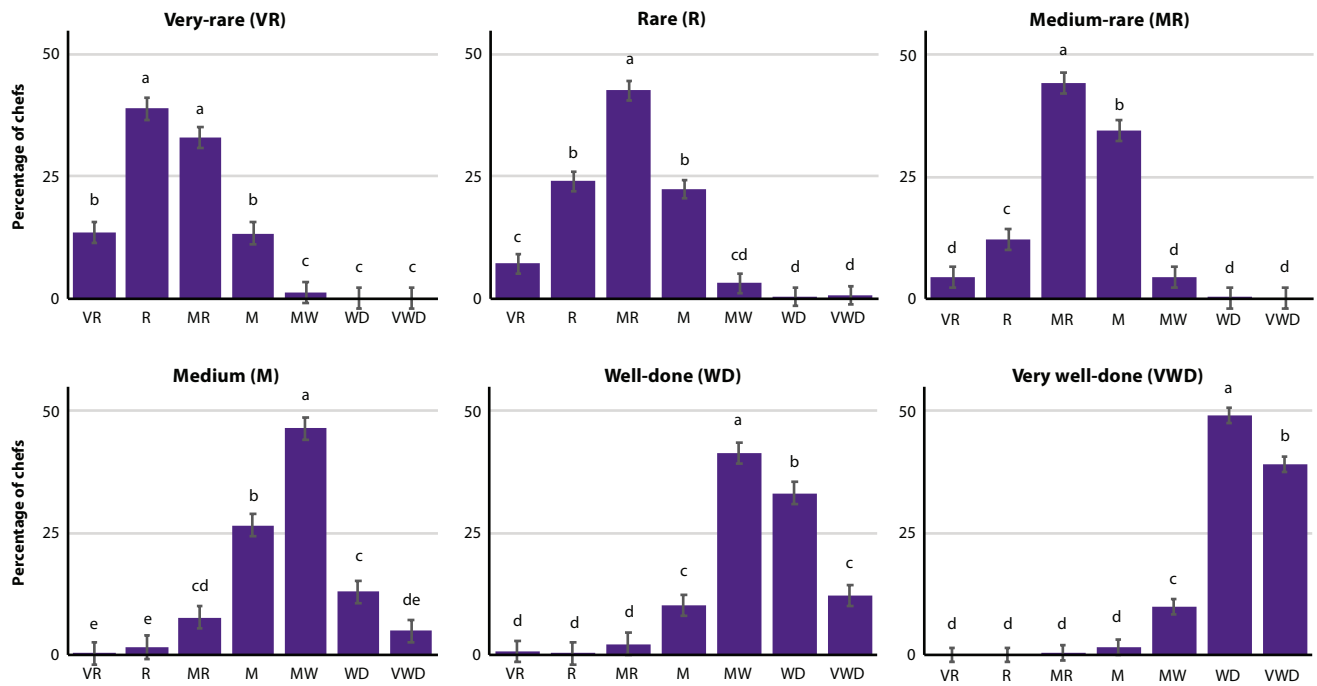


Figure 3. Percentage of chefs that correctly identified the represented degree of doneness on photographs of cooked beef strip loin steaks.