Pressed Juice Percentage Can Accurately Sort Beef into Categories of Predicted Juiciness

K. V. McKillip
Kansas State University, Manhattan, kognoskie@k-state.edu

A. K. Wilfong
Kansas State University, Manhattan, alaenawilfong@k-state.edu

J. M. Gonzalez
Kansas State University, johngonz@ksu.edu

See next page for additional authors

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Abstract

There are three main factors that contribute to meat palatability: tenderness, juiciness, and flavor (Bratzler, 1971). These three individual factors all play a role in the overall palatability perceived by a consumer. If a product fails for juiciness, there is a greater chance that it will fail in overall acceptability (Emerson et. al, 2013). In the past, research has established a method of segregating steaks based on tenderness acceptability. Researchers have been able to institute thresholds to be able to accurately explain at what shear force a steak will be rated tender by consumers. Similar methods have not been evaluated for juiciness until very recently when Woolley (2014) developed a method to objectively quantify beef juiciness. The method that was created included calculating the percentage of moisture loss from each sample after being compressed. From this work, thresholds for juiciness acceptability were established using loigistic regression; however, additional research is needed to verify these established thresholds. Therefore, the objective of this study was to determine the accuracy of previously established threshold values by testing consumer juiciness ratings for beef steaks in relation to objective juiciness measures.

Keywords

pressed juice percentage, juiciness, grade

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Authors

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Introduction

There are three main factors that contribute to meat palatability: tenderness, juiciness, and flavor (Bratzler, 1971). These three individual factors all play a role in the overall palatability perceived by a consumer. If a product fails for juiciness, there is a greater chance that it will fail in overall acceptability (Emerson et. al, 2013). In the past, research has established a method of segregating steaks based on tenderness acceptability. Researchers have been able to institute thresholds to be able to accurately explain at what shear force a steak will be rated tender by consumers. Similar methods have not been evaluated for juiciness until very recently when Woolley (2014) developed a method to objectively quantify beef juiciness. The method that was created included calculating the percentage of moisture loss from each sample after being compressed. From this work, thresholds for juiciness acceptability were established using loigistic regression; however, additional research is needed to verify these established thresholds. Therefore, the objective of this study was to determine the accuracy of previously established threshold values by testing consumer juiciness ratings for beef steaks in relation to objective juiciness measures.

Key words: pressed juice percentage, juiciness, grade

Experimental Procedures

Beef strip loins (n=72; 12/treatment) were selected at a Midwestern processing plant to represent six treatment groups: USDA Prime, Low Choice, Low Select, Prime Enhanced, Low Choice Enhanced, and Low Select Enhanced. Within each quality grade, half were enhanced to 108% of raw weight with a solution formulated to result in 0.35% salt, and 0.4% phosphate in the final injected product. Consecutively cut steaks were paired and assigned for consumer (N=252) evaluation and objective measurements. On the day of evaluation, steaks were cooked on a clamshell grill (Cuisinart, East Windsor, NJ) to a specific degree of doneness: rare (140°F), medium (160°F), or very well done (180°F) in order to maximize differences in juiciness. Steaks were evaluated by consumer panelists for juiciness on 100 point line scale, with 0 anchored at "extremely dry," 100 anchored at "extremely juicy," and 50 anchored at "neither dry nor juicy." Paired steaks for objective measurement were cooked

as previously described and evaluated for Pressed Juice Percentage (PJP) using the methods described by Woolley (2014), with samples compressed for 30 seconds at 17.64 lb of pressure. Samples were segregated into categories based on the probability of being rated juicy by consumers with PJP thresholds set at <14.64% (< 50% chance of being rated juicy), 14.64-18.94% (50-75% chance of being rated juicy), 18.94-23.25% (75-90% chance of being rated juicy), and >23.25% (>90% chance of being rated juicy).

Results and Discussion

The juiciness threshold values established by Woolley (2014) represent a PJP range and predicted percentage of samples within the range that would be expected to be rated as "juicy" by consumers. To test these thresholds, we segregated steaks into the predetermined categories based on results from PJP testing. The paired steaks were evaluated by consumers and determined to either be rated as "juicy" or not (Table 1). Our results found that in the first category with a predicted percentage of samples rated as "juicy" of less than 50%, the actual percentage rated juicy was 41.67%. In the second category, where the predicted probability of the sample rated juicy of 50% to 75%, our actual percentage rated juicy was 72.31%. Within the third category (75% to 90% predicted), our actual percentage of samples rated juicy was 89.33%. Lastly, the final category with the expected probability over 90% rated juicy, our actual percentage rated juicy was 98.08%. These results indicate the established expected probability categories were able to accurately segregate beef into categories of juiciness. This allows for potential marketing of "guaranteed juicy" products based on PJP segregation.

A regression equation was calculated based on the consumer ratings for juiciness and Pressed Juice Percentage of each steak sample (Figure 1). The PJP method predicted (P<0.05) consumer juiciness rating by the equation $y = 2.16x + 20.54$ (R^2=0.30). This indicates that the PJP method explained more than 30% of the variation in consumer juiciness ratings. This percentage of variation explained is similar to the amount of variation explained by Warner-Bratzler shear force and Slice Shear force values for tenderness, indicating the PJP method is as accurate for juiciness prediction as these two, industry-standard, methods are for tenderness.
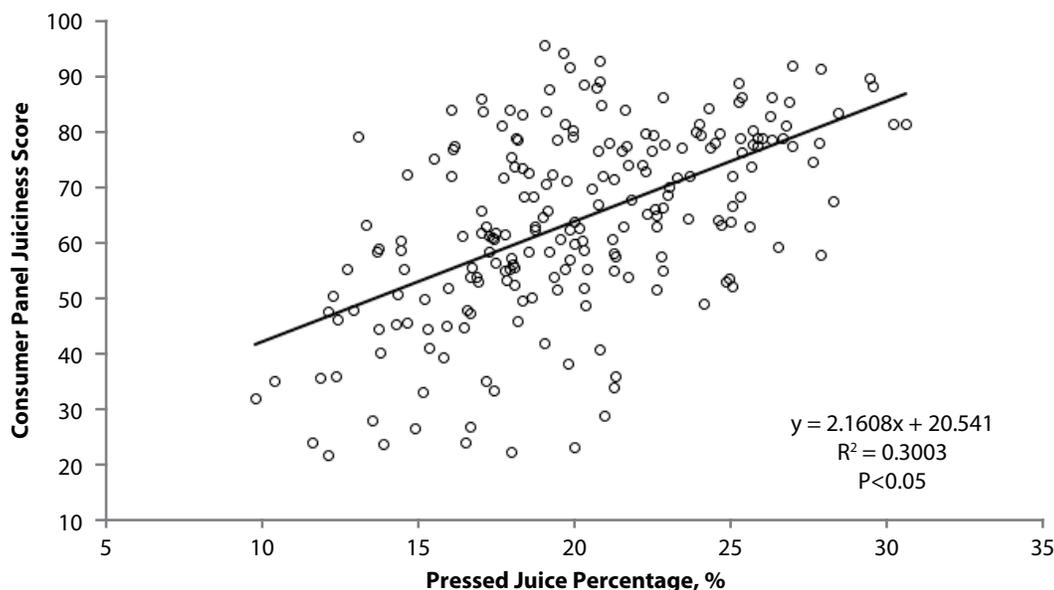
Implications

These data indicate the Pressed Juice Percentage was able to accurately segregate steaks into categories based on the probability of being rated juicy by consumers, validating the threshold ranges previously established.

Acknowledgments

Table 1. Pressed Juice Percentage thresholds and the corresponding predicted and actual percentage of beef strip loin steaks rated juicy by consumer panelists (n=252)

Pressed Juice Percentage threshold range (%)	Predicted probability of sample rated juicy (%)	Actual number of samples rated juicy	Total number of samples in range	Actual percentage of samples rated juicy
< 14.64	< 50	10	24	41.67
14.64-18.94	50– 75	47	65	72.31
18.94-23.25	75 – 90	67	75	89.33
>23.25	> 90	51	52	98.08

$y = 2.1608x + 20.541$
$R^2 = 0.3003$
$P<0.05$

Figure 1. Regression equation for predicting consumer sensory panel juiciness scores (0=extremely dry, 50=neither dry nor juicy, 100=extremely juicy) for beef strip steaks by Pressed Juice Percentage.