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Evaluation of the Insurance Theory Using Objective Measurements of Tenderness, Juiciness, and Proximate Composition of Beef Strip Steaks

L. N. Drey*, L. L. Prill, B. A. Olson, E. A. Rice, J. M. Gonzalez, J. L. Vipham, T. A. Houser, E. A. Boyle, and T. G. O'Quinn

Animal Sciences and Industry, Kansas State University, Manhattan, KS, 66506, USA
*Corresponding author. Email: lndrey@ksu.edu (L. N. Drey)

Objectives

The objective of this study was to evaluate the insurance theory with objective measurements of tenderness, juiciness, and raw and cooked proximate analysis, and to determine their relationship with sensory scores.

Materials and Methods

Paired strip loins (IMPS # 180) were collected to equally represent 5 quality treatments [Prime, Top Choice (Modest and Moderate marbling), Low Choice, Select, and Select Enhanced (110% of initial raw weight); $n = 12$ pairs/quality treatment]. Following a 21d aging period, strip loins were fabricated into 2.5cm steaks with the face steak designated for raw proximate analysis. Steaks were grouped into sets of 3 consecutive steaks. Each set within a strip loin pair were randomly assigned a degree of doneness (DOD): very-rare (VR; 55°C), rare (RA; 60°C), medium-rare (MR; 63°C), medium (ME; 71°C), well-done (WD; 77°C), or very well-done (VWD; 82°C), so that each carcass had representation for each DOD. Steaks were cooked to their designated DOD on a clamshell grill (Cuisinart Griddler Deluxe, Model GR-150, Stamford, CT) with temperatures monitored using a probe thermometer (Super-Fast Thermopen, ThermoWorks, American Fork, UT). From each DOD group, one steak was used for Slice Shear force (SSF), Warner Braztler shear force (WBSF), pressed juice percentage (PJP), and cooked proximate analysis. The other 2 steaks were assigned to consumer or trained sensory testing. Data were analyzed as a split-plot with the whole plot factor of quality treatment and sub-plot factor of degree of doneness.

Results

There was an interaction ($P < 0.05$) between DOD and quality treatment for cooked moisture (CM), cooked fat (CF), and cooked moisture + fat (CMF). Select Enhanced contained the greatest ($P < 0.05$) CM content, and Prime the least ($P < 0.05$) across all DOD. Select had similar ($P > 0.05$) CM to Low Choice at R, M, and VWD. At VR, R, and MR, Prime contained the greatest ($P < 0.05$) CF content, followed by Top Choice and Low Choice, with Select having similar ($P > 0.05$) CF content to Select Enhanced. However, when cooked to M and higher, Low Choice, Select, and Select Enhanced had similar ($P > 0.05$) CF. Prime was similar ($P > 0.05$) to Select Enhanced for CMF when cooked to R and MR, and similar ($P > 0.05$) to Top Choice at VR, MR, and M. Top Choice, Low Choice and Select samples had similar ($P > 0.05$) CMF when cooked to VR, R, and VWD. When evaluating the correlation coefficients, CM was associated ($P < 0.01$) with consumer juiciness ($r = 0.27$), tenderness ($r = 0.17$), flavor liking ($r = 0.23$), and overall liking ($r = 0.19$), while CF was associated ($P < 0.05$) with consumer juiciness ($r = 0.12$) and tenderness ($r = 0.15$). The strongest ($P < 0.01$) correlations for consumer juiciness, tenderness, flavor liking, and overall liking occurred with CMF ($r = 0.69$, $r = 0.56$, $r = 0.45$, and $r = 0.49$, respectively). A logistic regression was performed to predict the probability of a sample being rated juicy by consumers using CMF, and had an adjusted R^2 value of 0.47. The model identified CMF percentages of 68.25, 69.85, and 71.20% for a probability of 50, 75, and 90% for a consumer rating a steak juicy.

Conclusion

Combined, cooked moisture and fats showed the strongest association with consumer sensory scores and could be used to predict whether a strip steak would be rated juicy by a consumer.