

NATIONAL BEEF TENDERNESS SURVEY – 2022: ASSESSMENT OF WARNER-BRATZLER SHEAR FORCE AND CONSUMER PANEL EVALUATION OF BEEF STEAKS

Mackenzie G. Chapman, Ayleen A. Gonzalez, E. Paige Williams, Trent E. Schwartz, Ashley N. Arnold, Davey B. Griffin, Rhonda K. Miller, Kerri B. Gehring and Jeffrey W. Savell*

Texas A&M University, Department of Animal Science, College Station, Texas

*Corresponding author email: j-savell@tamu.edu

I. INTRODUCTION

Tenderness is a primary contributor to overall consumer satisfaction and acceptability [1-3]. The National Beef Tenderness Survey (NBTS) evaluates the palatability of U.S. retail and food service beef steaks. The objectives of this study were: (1) to establish a new benchmark of tenderness and other sensory attributes of retail and foodservice steaks using Warner-Bratzler shear (WBS) force and consumer sensory panel, and (2) to obtain packaging information about branding, claims, quality grade, and other marketing strategies of steaks sold in the U.S.

II. MATERIALS AND METHODS

Retail products were purchased in eleven U.S. cities between October 2021 through February 2022. Cities were selected to provide geographical range and to uphold historical association from previous studies. The following cuts were purchased: Top blade steak; Ribeye steak, lip on, boneless; Ribeye steak, lip on, bone-in; Top loin steak, boneless; Top loin steak, bone-in; T-bone steak; Porterhouse steak; Top sirloin steak, boneless, cap off; Tenderloin steak, side muscle off, defatted. Retail steaks were randomly assigned to WBS force evaluation or consumer sensory panel. The following cuts were obtained for foodservice evaluation: Ribeye steak, lip-on, boneless; Strip loin steak, boneless; Top sirloin butt steaks, boneless; and Tenderloin steaks, side muscle off, defatted. Grated, non-stick electric grills, preheated to 177°C. were used to cook all retail steaks. Garland™ gas grills, preheated to 232°C, were used to cook all the foodservice steaks. Internal temperature of steaks was monitored with a thermocouple reader (Omega™ HH506A, Stamford, CT) with a 0.02-cm diameter copper-constantan Type-T thermocouple wire inserted into the geographic center of each steak. Steaks were flipped at 35°C internal temperature and removed from the grill once the internal temperature reached 70°C. For WBS force, 1.3-cm cores were sampled parallel to the muscle fibers from the primary muscle of each steak. For consumer panels, cooked steaks were cubed into 1.27-cm x 1.27-cm x steak thickness. Panelists rated steaks for overall liking, flavor liking, juiciness liking, tenderness level, and tenderness liking. Data were analyzed with JMP Pro Version 16.0.0 and Microsoft Excel to determine frequency distribution and analyze percentages of steaks stratified into previously defined tenderness classes. Least squares means were calculated with steak type as a main effect for steak measurements and retail WBS force analysis.

III. RESULTS AND DISCUSSION

For both retail and foodservice steaks, tenderloin steaks had the lowest WBS force value, at 13.3 N and 25.4, respectively. For retail steaks, top sirloins had the highest WBS force value, and top loins had the highest WBS force value at 38.0 N in foodservice steaks. The top blade, bone-in ribeye, Porterhouse, and tenderloin retail cuts had shear force values in the very tender (< 31.4 N) category.

Retail top sirloin was the lone cut in the tough category (> 45.1 N). In retail consumer sensory evaluation, tenderloin steaks received the highest ($P < 0.05$) rating for overall like, tenderness like, tenderness level, flavor like, and juiciness like. To be comparable to previous years' surveys, if the tenderloin had not been included in the survey, the top blade would have received among the highest panelist ratings. Of retail packages, approximately 66.4% contained a form of branding, and 55.9% had a marketing claim. Which increased from the previous survey [4], where only 34.5% of retail packages contained any company or marketing claim. Top sirloin steaks received the lowest sensory ratings for overall like, tenderness like, tenderness level, flavor like, and juiciness like. Compared to the last three surveys, there was an increase in the number of packages with brands or claims on labels. This may indicate the consumer is more interested in the origin of their food. Most retail steaks evaluated were very tender, and all decreased in WBS force from the 2010 [5] and 2015 [4] survey.

Table 1. Least squares means and SE for Warner-Bratzler shear force values (N) of steaks from retail establishments

Steak	n	Shear force mean, N ¹	SE
Top blade	30	16.73 ^d	0.99
Ribeye, lip on, bone-in	36	19.88 ^{bc}	0.90
Ribeye, lip on, boneless	108	19.70 ^c	0.52
Top loin, boneless	132	18.62 ^{cd}	0.47
Porterhouse	29	20.65 ^{abc}	1.01
Top sirloin, boneless, cap off	179	22.01 ^a	0.41
Tenderloin	86	13.31 ^e	0.58
<i>P</i> -value		<0.0001	

¹Warner-Bratzler shear force was determine using 1.27 cm diameter cores.

^{a-e} Least squares means with different superscript letters differ ($P < 0.05$).

IV. CONCLUSION

Most retail steaks evaluated in this study were considered very tender, and all retail cuts decreased in WBS force value when compared to the 2015 [4] and 2010 [5] surveys. Although the ribeye and top loin foodservice steaks showed an increase in WBS force values when compared to the 2015 [4] survey, this increase did not impact consumer rating of the product.

ACKNOWLEDGEMENTS

Funded, in part, by the Beef Checkoff.

REFERENCES

1. Neely, T.R., Lorenzen, C.L., Miller, R.K., Tatum, J.D., Wise, J.W., Taylor, J.F., Buyck, M.J., Reagan, J.O., & Savell, J.W. (1998). Beef Customer Satisfaction: Role of cut, USDA quality grade, and city on in-home consumer ratings. *Journal of Animal Science* 76:1027-1033.
2. Lorenzen, C.L., Neely, T.R., Miller, R.K., Tatum, J.D., Wise, J.W., Taylor, J.F., Buyck, M.J., Reagan, J.O., & Savell, J.W. (1999). Beef Customer Satisfaction: Cooking method and degree of doneness effects on the top loin steak. *Journal of Animal Science* 77:637-644.
3. Savell, J.W., Lorenzen, C.L., Neely, T.R., Miller, R.K., Tatum, J.D., Wise, J.W., Taylor, J.F., Buyck, M.J., & Reagan, J.O. (1999). Beef Customer Satisfaction: Cooking method and degree of doneness effects on the top sirloin steak. *Journal of Animal Science* 77:645-652.
4. Martinez, H.A., Arnold, A.N., Brooks, J.C., Carr, C.C., Gehring, K.B., Griffin, D.B., Hale, D.S., Mafi, G.G., Johnson, D.D., Lorenzen, C.L., Maddock, R.J., Miller, R.K., VanOverbeke, D.L., Wasser, B.E., & Savell, J.W. (2017). National Beef Tenderness Survey–2015: Palatability and shear force assessments of retail and foodservice beef. *Meat and Muscle Biology* 1:138-148.
5. Guelker, M.R., Haneklaus, A.N., Brooks, J.C., Carr, C.C., Delmore, R.J., Jr., Griffin, D.B., Hale, D.S., Harris, K.B., Mafi, G.G., Johnson, D.D., Lorenzen, C.L., Maddock, R.J., Martin, J.N., Miller, R.K., Raines, C.R., VanOverbeke, D.L., Vedral, L.L., Wasser, B.E., & Savell, J.W. (2013). National Beef Tenderness Survey-2010: Warner-Bratzler shear force values and sensory panel ratings for beef steaks from United States retail and food service establishments. *J Anim Sci* 91:1005-14.