



Beef you can count on.

CONSUMER TESTED. CONSUMER APPROVED.

CONSUMERS VS. MACHINES: WHO IS THE BEST JUDGE FOR PALATABILITY?

- Consumer satisfaction is the gold standard for repeat sales of beef.
- Narrowly-focused testing and research – focused solely on shear force, at the expense of juiciness, flavor, and tenderness – can lead to misleading predictions of consumer satisfaction.
- Predicting consumer satisfaction requires consumer testing and evaluation for all three palatability factors: flavor, juiciness and tenderness.

Meeting high consumer expectations for beef requires a balanced equation:

$$\text{Beef Palatability} = \text{Flavor} + \text{Juiciness} + \text{Tenderness}$$

Flavor:

Beef flavor is complex, and affected by many factors, including:

- Animal breed, diet, age and gender
- Marbling and fat present in the meat
- Post-harvest enhancements, including aging, marination and others
- Cooking method, degree of doneness and preparation
- Type of muscle (muscle cut, subprimal)

Juiciness:

Factors influencing juiciness include:

- Marbling
- Cooking method/preparation
- Degree of doneness, preparation

Tenderness:

Like flavor, tenderness also can be influenced by multiple factors, including:

- Aging
- Marbling
- Animal age and breed
- Genetics
- Type of muscle (muscle cut, subprimal)
- Feed supplements and implants
- Pre-harvest treatments, including Vitamin D
- Post-harvest enhancements, including aging, mechanical tenderization, and others
- Degree of doneness

SHEAR FORCE MEASURES TENDERNESS ... SORT OF

Warner-Bratzler shear force (WBSF) and slice shear force (SSF) are mechanical, objective means to determine the force necessary to slice through a piece of meat. For WBSF, six cores are taken from various locations in the steak sample. A special blade slices through a uniform-sized meat core removed from a steak, perpendicular to the muscle fibers once meat is cooked and chilled. SSF differs slightly – it can be tested with warm samples, and the procedure takes one measurement per steak, from a 1-inch section, using a different blade compared to WBSF to slice through the sample.

WBSF and SSF originally were designed to determine objective, mechanical differences among samples from different treatment groups, in a single trial. While they provide an estimate of the force necessary to mimic the first downward motion of someone chewing through meat, the measures have two caveats:

1. There is no way to tell whether WBSF or SSF values – or changes in values – are favorable or unfavorable, except at the outer extremes.
2. They do not measure consumer acceptability.

Are there tenderness thresholds?

Because they're quick and inexpensive, shear force measurements often are used – incorrectly – in attempts to predict overall meat acceptability. Many researchers have tried to identify tenderness thresholds but have generated conflicting results. There is no 100% guarantee of consumer satisfaction or acceptability based on shear force or any one palatability factor alone.¹

Source	Threshold notes
Shackelford et al. 1991 ²	4.6 kg and 3.9 kg give 50% or 68% confidence that a consumer would find the sample slightly tender
Meilgaard et al. 1999 ³	Some experts question the validity of sensory “thresholds” because they are ill-defined in theory, may not reproduce results well, and may not even exist
Miller et al. 2001 ⁴	93% satisfaction in tenderness at 3.0-4.3 kg; 86% satisfaction in tenderness between 4.3 and 4.9 kg
Platter et al. 2003 ⁵	Shear of 4.5 kg has a predicted probability of acceptance of 0.50. Slope is greatest between 3.0-5.5 kg
ASTM suggestions, 2010	Certified Very Tender 4.4 kg (20.0kg SSF); Certified Tender 3.9 kg (15.4 SSF)



CONSUMER SENSORY RESEARCH PLAYS IMPORTANT ROLE IN BEEF RESEARCH

Two types of consumer sensory research typically are used to evaluate beef: consumer sensory panels and trained sensory panels.

Consumer sensory panels:

Consumer sensory research allows consumers – those who repeatedly buy beef – to rate how they perceive different traits (flavor, color or other traits), and to express opinions about whether or not products are acceptable. No other type of sensory testing provides that critical consumer feedback. To overcome personal biases or opinion differences, sensory research requires a large number of testers, which adds significant time and expense.

Consumer sensory research rarely is used in fresh beef research because of the time and expense. When used, it provides a true interpretation of acceptability of the beef itself and production practices or technologies that ensure an adequate supply of beef that meets consumer standards.

Trained sensory panels:

Trained sensory panels are used frequently in beef research. Trained panelists each should give the same score for the same sample or, if served the same sample repeatedly, should always give the same response. Unlike consumer panelists, trained panelists are educated to ignore personal preferences so they can't evaluate overall acceptability.

Which method is best to evaluate beef?

When you want to know:	Consumer Panel	Shear Force	Trained Panel
Overall consumer acceptability	X		
Perceptions of palatability attributes (tenderness, flavor, juiciness)	X		X
Quick, objective measure to determine the shear force of beef		X	
Small differences in resistance required to slice through meat		X	X
Perceptions of flavor attributes (tenderness, flavor, juiciness) after being trained to compare with objective measures (i.e., shear force)			X



THE BOTTOM LINE: CONSUMER TESTING AND EVALUATION IS THE GOLD STANDARD

- Recent research with emphasis on shear force alone, rather than the palatability combination of flavor, juiciness and tenderness, may result in potentially misleading predictions of the type of product that consumers will find acceptable.
- Meeting high consumer expectations for beef requires a balanced equation:
Beef Palatability = Flavor + Juiciness + Tenderness
- Three factors – flavor, juiciness and tenderness – appear to play equal roles in determining palatability. Consumer satisfaction correlates with desirable scores on all three factors.⁷

Consumer – Rated Beef Samples Correlation of Palatability Scores⁷

	Undesirable scores (1-3)	Neutral Scores (4-5)	Desirable Scores (6-8)	All Scores (1-8)
Flavor	0.18	0.28	0.48	0.69
Juiciness	0.09	0.21	0.47	0.61
Tenderness	0.26	0.19	0.45	0.65
Summary – relationship between palatability traits and beef desirability	Minimal relationship: No one factor – or some factors other than palatability – account for the undesirable scores.	Little relationship: Each factor plays an equally small role in the score, with flavor having a bigger impact than the other traits.	Equal relationship: All factors are nearly the equal in contributing to desirability, with flavor playing a slightly stronger role.	Equal relationship: All factors contribute nearly equally in determining consumer scores.

Merck Animal Health is an animal health industry leader in using consumer research to evaluate the impacts of its products on quality and satisfaction. Merck Animal Health has sponsored one of the largest consumer fresh beef sensory evaluations ever conducted⁶, and continues to conduct consumer taste tests to evaluate company product impacts on acceptability.

References

- ¹Lorenzen, C. L., Miller, R. K., Taylor, J. F., Neely, T. R., Tatum, J. D., Wise, J. W., Buyck, M. J., Reagan, J. O. and Savell, J. W. Beef Customer Satisfaction: Trained sensory panel ratings and Warner-Bratzler shear force values. *J. Ani. Sci.* 2003. 81:143-149.
- ²Shackelford et al. Identification of threshold levels for Warner-Bratzler shear force in beef top loin steaks. *J. Musc. Foods.* 1991. 2:289-296.
- ³Meilgaard et al. Determining thresholds. *Sensory Evaluation Techniques.* 3rd Ed. CRC Press. Boca Raton, FL. 1999. p123-132.
- ⁴Miller et al. Consumer thresholds for establishing the value of beef tenderness. *J. Ani. Sci.* 2001. 79:3062-3068.
- ⁵Platter et al. Relationships of consumer sensory ratings, marbling score, and shear force value to consumer acceptance of beef strip loin steaks. *J. Ani. Sci.* 2003. 81:2741-2750.
- ⁶Mehaffey et al. Effect of feeding zilpaterol hydrochloride to beef and calf-fed Holstein cattle on consumer acceptability. *J. Ani. Sci.* 2009. 87:3712-3721.
- ⁷Data on file.

Merck Animal Health
For more information, go to www.zilmax.com.

IMPORTANT SAFETY INFORMATION

Zilmax has a withdrawal period 3 days prior to slaughter. Not for use in animals intended for breeding. Do not allow horses or other equines access to feed containing zilpaterol. Do not use in veal calves. Not to be fed to cattle in excess of 90 mg zilpaterol/head/day in complete feed. If pen consumption of complete feed exceeds 26.5 lb/head/day (90% dry matter basis), zilpaterol should not be fed in complete feed. For complete safety information, refer to product label and Zilmax website.

