We may need to get more vocal about this topic. I feel that the signal must come from industry. So, for example, the next time you would like to hire an individual with some meat science training for an internship, summer position or special project, call a university food or animal science department and let us (meaning the academic community) know. Early exposure to the meat industry will help prepare graduates for work in this industry and may also spark interest in continuing on to graduate degrees. The university administration may also take notice when companies come to campus to recruit or when a number of position notices go unfilled.

An important link also exists between graduate student education and research, as research funds fuel most graduate student projects. On a national level, we must look for ways to increase funding of research in meat science topics. The Natural Sciences and Engineering Research Council (NSERC) has several initiatives that provide for joint funding of research projects with industry support. For example, for a minimum contribution of $5,500 per year from a company, the NSERC Industrial Postgraduate Scholarship Program will contribute an additional $13,8000 toward a graduate student scholarship and the company gets the added benefit of research of mutual interest. Our membership includes many of Canada's top meat scientists and meat and poultry companies and affiliated agencies. So, make a connection and get another graduate or two entering our profession.

Well, I'll get off my soapbox now. I welcome your questions and comments.

MEAT PROCESSING: The Influence of Mechanical Tenderization on the Palatability of Certain Bovine Muscles

L. E. Jeremiah, AAFC, Lacombe

BIOGRAPHIC DETAILS

L.E. Jeremiah is presently a research scientist with Agriculture and Agri-Food Canada at their Lacombe (Alberta) Research Centre. He is in charge of all sensory and consumer meat research studies and is program leader for preservative packaging research.

He received his B.Sc. in Animal Science from Washington State University in 1965, his M.Sc. in Animal Husbandry (Meat Technology) from the University of Missouri in 1967 and his Ph.D. in Animal Science (Meat Science) from Texas A&M University in 1971.

Dr. Jeremiah worked as a meat laboratory technician, research assistant, county extension agent, teaching assistant, real estate salesman, county extension director, and technical writer, before accepting his present position in February 1975

Dr. Jeremiah's research stimulated improvements in both vacuum packaging equipment and materials, provided the basis for improvement and revision of lamb carcass grading standards in both Canada and the United States and resulted in the development of a simple, nondestructive means for segregating beef carcasses into tenderness groups, a processing and packaging system to markedly extend pork storage life to facilitate export to remote markets, and contributed to the development of a non-mechanically refrigerated container to achieve temperature control during the distribution of display-ready meat products. Dr. Jeremiah has extensively researched the effects of freezing, frozen storage, and thawing on meat, the contribution of fat content to palatability and consumer acceptance; extension of chilled meat storage life; and postmortem technologies, used in meat production and processing. Dr. Jeremiah pioneered the use of sensory profiling approaches in meat research, and has provided comprehension reviews on factors affecting meat quality, the contribution of marbling to beef palatability, and factors contributing to consumer selection and acceptance of meat purchases.

Dr. Jeremiah was cofounder of the Canadian Meat Science Association and has served as western director and as president-elect, president, and past-president twice. Dr. Jeremiah is also a professional member of the American Meat Science Association, Institute of Food Technologists, Canadian and American Societies of Animal Science, and the Canadian Institute of Food Science and Technology. He was formerly coordinator of the Western Canadian Research Group on Extended Storage of Meat and Meat Products (an interdisciplinary, interinstitutional network of research scientists, engineers, and technology transfer specialists) and an adjunct professor in the Department of Food Science at the University of Alberta.

The Influence of Mechanical Tenderization on the Palatability of Certain Bovine Muscles

L.E. Jeremiah, AAFC, Lacombe

The success of any product in the marketplace depends upon its appeal and acceptability to the consumer. Consequently, for any industry to be successful it must be aware of consumer preferences and desires regarding its product. The beef industry is no different.

Although a relatively high proportion of Canadian consumers interviewed in a recent survey perceived the quality of beef to have improved over the past decade (31.2%), because it had become leaner (63.6%), it had become more tender (16.7%), it had become more flavorful (14.5%), the breeding and feeding of beef animals had improved (14.1%), and more appropriate beef cuts had been provided (12.8%), a relatively large proportion of the consumers interviewed (27.5%) also perceived beef quality to have deteriorated over the past decade, because it had become less tender (17.5%), it contained more preservatives, chemicals, and additives (14.6%), and beef animals were force-fed (10.2%) and fed more chemicals (9.7%) (Jeremiah et al. 1993).

Although consumer preferences regarding beef can vary widely among nationalities, religions, geographical locations and income and educational levels, it is obvious consumer satisfaction with beef after purchase is based almost exclusively on eating satisfaction (Jeremiah, 1982) and eating satisfaction, in the case of beef, is primarily determined by tenderness (Jeremiah, 1981). Recent Canadian consumer surveys have clearly demonstrated approximately 30% of the beef currently available for purchase is unacceptable in tenderness and the tenderness of beef currently available for purchase is excessively variable in tenderness to assure consistent consumer satisfaction (Jeremiah et al. 1992 McDonell, 1990). These conclusions were based on consumer evaluations of longissimus (rib and loin) steaks. Past research has clearly documented anatomical locations within a muscle, muscles, and cuts of meat differ considerably in tenderness (Jeremiah 1978), with muscles used for locomotion (round and chuck) being considerably less tender than muscles used for support (rib and loin) (Jeremiah 1978). Consequently, any means to improve the tenderness of the shoulder and leg muscles would be clearly beneficial to the beef industry in achieving its goal of 95% consumer acceptance.

Although a considerable amount of research has been conducted on the effects of mechanical (blade) tenderization on beef cooking and palatability properties, these studies have largely focused on one or two muscles in isolation (Jeremiah et al. 1999). A recent study was conducted which evaluated the effects of mechanical tenderization on twelve different muscles or muscle groups (Jeremiah *et al.* 1999). These muscles or muscle groups were removed from both sides of 25 Canada AA beef carcasses. Muscles or muscle groups from alternate carcass sides were either mechanically tenderized or served as controls (Table 1).

Mechanical tenderization increased thaw-drip losses from the brisket approximately 1.25% and cooking losses from the blade-eye by approximately 2.75%, but did not influence cooking times. Mechanical tenderization improved the initial and overall tenderness of the outside round, top sirloin, striploins, inside round and chuck tender (Table 2). Mechanical tenderization also improved the initial tenderness of the sirloin-tip eye and the overall tenderness of the eye of round. In addition, mechanical tenderization made the connective tissue less perceptible in the top sirloin, striploins, and eye of round. However, it reduced the flavor intensity of the top sirloin and rib-eye, but improved the flavor desirability of the inside round. Moreover, the overall palatability of the inside round and eye of round was improved by mechanical tenderization. It should be noted, however, all of the previously mentioned differences had a magnitude of less than one full panel unit, and therefore would normally be considered to be of marginal practical importance. However, mechanical tenderization did decrease the proportion of inside round samples rated tough initially and overall from 52 to 20 % and from 36 to 12% respectively (Table 3), and also reduced the proportion of outside round sample perceived to have slight or greater amounts of connective tissue from 36 to 12%. In addition, mechanical tenderization reduced the proportion of inside round samples with undesirable flavor from 16 to 0%, and reduced the proportion of unpalatable rib-eye, inside round, and eye of round samples from 12 to 0, 36 to 8, and 80 to 40%, respectively. Consequently, mechanical tenderization can be effectively utilized to reduce the variability in and improve both tenderness and palatability of certain muscles, particularly hip muscles. The shift in frequency of overall tenderness ratings to higher levels produced by mechanical tenderization in certain muscle and muscle groups (for example the eye of round, a popular but notoriously tough steak cut purchased by consumers) may provide substantial benefit to the beef industry (Figure 1)

Acknowledgements

This study was funded by the Beef Information Centre and the Beef Industry Development Fund. The collaboration and guidance of Dr. J.L. Aalhus is gratefully acknowledged, as is the expert technical assistance of Lorna Gibson and Becky Cunningham.

References

Jeremiah, L.E. 1978. A review of factors affecting meat quality. Lacombe Res. Stn. Tech. Bull. No. 1, Lacombe, AB.

Jeremiah, L.E. 1981. Factors affecting consumer selection and acceptability of beef in central Alberta. J. Cons. Stud. Home Econ. **5**, 257-268.

Jeremiah, L.E. 1982. A review of factors influencing consumption, selection, and acceptability of meat purchases. J. Cons. Stud. Home Econ. **6**, 137-154.

Jeremiah, L.E., Gibson, L.L., and Cunningham, B. 1999. The influence of mechanical tenderization on the palatability of certain bovine muscles. Food Res. International **32**, 585-593.

Jeremiah, L.E., Tong, A.K.W., Jones, S.D.M., and McDonell, C. 1992. Consumer acceptance of beef with different levels of marbling. J. Cons. Stud. Home Econ. **16**, 375-387.

Jeremiah, L.E., Tong, A.K.W., Jones, S.D.M., and McDonell, C. 1993. A survey of Canadian consumer perceptions of beef in relation to general perceptions regarding foods. J. Cons. Stud. Home Econ. **17**, 13-37.

McDonnell, , C. 1990. Canadian consumer perceptions of beef. Conception to Consumption Conf., Brandon, MB, Nov 13-14.

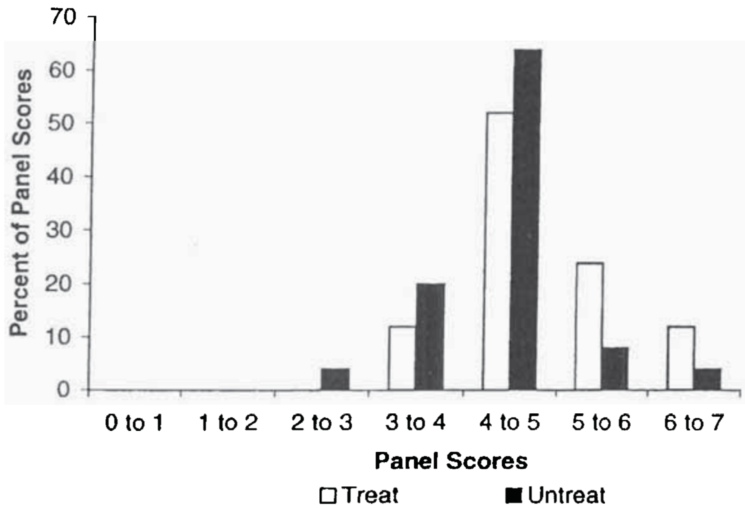

Figure 1. The distribution of eye of round overall tenderness ratings

Table1 Muscles or Muscle groups evaluated

Industrial Name	Muscle	Wholesale Cut	Sample Location
Sirloin tip eye	Rectus femoris	Sirloin tip	Dorsal
Outside flat round	Biceps femoris	Outside round	Dorsal
Eye of round	Semitendinosus	Outside round	Dorsal
Inside round	Semimembranosus	Inside round	Central
Top sirloin butt eye	Gluteus medius	Top sirloin	Anterior
Striploin (main muscle)	Longissimus lumborum	Loin	Anterior
Rib-eye	Longissimus thoracis	Rib	Posterior
Short rib	Serratus ventralis	Short rib	Central
Blade eye	Blade combination (10 muscles)	Chuck	Anterior
Chuck tender	Supraspinatus	Chuck	Central
Cross rib (main muscle)	Triceps brachii (long head)	Chuck	Dorsal
Brisket	Deep pectoral	Brisket	Central

Table 2. Least squares means and standard errors for palatability attributes of certain muscles and muscle groups.

Muscle	Treatment	n	Initial Tenderness	Overall tenderness	Perceptible Connective Tissue	Juiciness	Flavor Intensity	Flavor Desirability	Overall Palatability
Sirloin Tip Eye	Cont.	25	5.04[b]	5.56	6.13	4.56	5.38	5.47	5.24
	Treat.	25	5.87[a]	6.22	6.50	4.38	5.28	5.52	5.46
	SE		0.28	0.25	0.22	0.21	0.16	0.17	0.19
Outside Round	Cont.	25	4.37[b]	4.70[b]	4.93	5.04	5.72	5.23	4.67
	Treat.	25	5.16[a]	5.36[a]	5.38	5.06	5.69	5.69	5.37
	SE		0.23	0.22	0.19	0.18	0.11	0.12	0.17
Eye of Round	Cont.	25	3.72	4.31[b]	5.21[b]	4.08	5.00	5.04	4.31[b]
	Treat.	25	4.23	4.88[a]	5.69[a]	4.08	4.95	5.34	4.81[a]
	SE		0.19	0.14	0.12	0.17	0.14	0.11	0.14
Inside Round	Cont.	25	4.41[b]	4.77[b]	5.19	4.54	5.38	5.31[b]	4.73[b]
	Treat.	25	5.27[a]	5.52[a]	5.69	4.46	5.14	5.73[a]	5.38[a]
	SE		0.22	0.19	0.19	0.13	0.13	0.12	0.16
Top Sirloin	Cont.	25	4.63[b]	5.34[b]	6.00[b]	5.16[a]	5.80[a]	5.58	5.35
	Treat.	25	5.47[a]	5.85[a]	6.42[a]	4.58[b]	5.33[b]	5.62	5.50
	SE		0.18	0.16	0.13	0.19	0.12	0.13	0.14
Striploin	Cont.	25	5.90[b]	6.11[b]	6.56[b]	5.18	5.19	5.76	5.68
	Treat.	25	6.71[a]	6.77[a]	7.02[a]	4.78	5.08	5.94	5.98
	SE		0.24	0.18	0.15	0.19	0.11	0.11	0.15

Continued…

Table 2 continued

Muscle	Treatment	n	Initial Tenderness	Overall tenderness	Perceptible Connective Tissue	Juiciness	Flavor Intensity	Flavor Desirability	Overall Palatability
Rib-Eye	Cont.	25	6.32	6.58	6.90	5.58	5.34[a]	5.92	5.97
	Treat.	25	6.78	6.82	7.02	5.11	4.88[b]	5.81	5.93
	SE		0.22	0.16	0.12	0.19	0.11	0.10	0.14
Short Rib	Cont.	13	5.61	5.22	5.06	6.56	6.02	2.53	4.31
	Treat.	13	5.56	5.42	5.34	6.62	6.21	2.89	4.55
	SE		0.30	0.26	0.24	0.11	0.13	0.27	0.27
Blade Eye	Cont.	25	4.89	5.51	5.66	5.80[a]	5.68	5.79	5.53
	Treat.	25	5.45	6.00	5.94	5.20[b]	5.50	6.11	5.92
	SE		0.20	0.17	0.17	0.16	0.10	0.12	0.16
Chuck Tender	Cont.	25	4.16[b]	4.90[b]	5.70	5.15	5.85	5.16	4.67
	Treat.	25	4.82[b]	5.37[a]	6.08	5.12	5.78	5.24	5.01
	SE		0.18	0.15	0.14	0.15	0.10	0.15	0.16
Cross Rib	Cont.	25	5.47	5.95	6.26	5.51	5.86	5.52	5.46
	Treat.	25	5.62	6.16	6.33	5.54	5.76	5.67	5.70
	SE		0.15	0.14	0.12	0.17	0.11	0.15	0.15
Brisket	Cont.	25	3.07	3.48	4.23	5.66	5.66	5.10	3.90
	Treat.	25	2.89	3.40	4.38	5.62	5.72	4.99	3.83
	SE		0.16	0.16	0.15	0.18	0.10	0.17	0.16

[a,b] Means in the same column and muscle and trait group bearing a different superscript differ significantly ($P<0.05$)

Table 3 The proportion (%) of samples in certain muscles and muscle groups perceived to be tough initially and overall, to contain a slight or greater amount of connective tissue, to be dry, to be undesirable in flavor, and to be unpalatable overall.

Muscle	Treatment	n	Initially Tough	Tough Overall	Slight Perceptible Connective Tissue or More	Dry	Undesirable Flavor	Unpalatable
Sirloin Tip Eye	Cont.	25	36.0	20.0	12.0	52.0	16.0	36.0
	Treat.	25	24.0	12.0	4.0	52.0	4.0	16.0
Outside Round	Cont.	25	56.0	44.0	36.0[a]	26.0	20.0	52.0
	Treat.	25	32.0	20.0	12.0[b]	20.0	12.0	24.0
Eye of Round	Cont.	25	96.0	76.0[a]	12.0	68.0	24.0	80.0[a]
	Treat.	25	72.0	32.0[b]	4.0	80.0	8.0	40.0[b]
Inside Round	Cont.	25	52.0[a]	36.0[a]	28.0	56.0	16.0[a]	36.0[a]
	Treat.	25	20.0[b]	12.0[b]	8.0	60.0	0.0[b]	8.0[b]
Top Sirloin	Cont.	25	48.0	12.0	4.0	32.0	12.0	12.0
	Treat.	25	24.0	4.0	0.0	52.0	12.0	12.0
Striploin	Cont.	25	16.0	16.0	0.0	28.0	8.0	8.0
	Treat.	25	4.0	4.0	0.0	48.0	0.0	4.0
Rib-Eye	cont.	25	8.0	4.0	0.0	12.0	0.0	12.0[a]
	Treat.	25	8.0	0.0	0.0	24.0	0.0	0.0[b]
Short Rib	Cont.	13	15.4	30.8	30.8	0.0	30.8	61.5
	Treat.	13	15.4	23.1	15.4	0.0	38.5	61.5
Blade Eye	Cont.	25	36.0	20.0	12.0	8.0	4.0	8.0
	Treat.	25	20.0	8.0	4.0	24.0	0.0	12.0
Chuck Tender	Cont.	25	68.0	32.0	8.0	36.0	24.0	32.0
	Treat.	25	48.0	20.0	0.0	24.0	16.0	24.0
Cross Rib	Cont.	25	12.0	0.0	0.0	12.0	8.0	16.0
	Treat.	25	12.0	4.0	0.0	4.0	4.0	4.0
Brisket	Cont.	25	96.0	88.0	68.0	20.0	28.0	88.0
	Treat.	25	96.0	100.0	68.0	16.0	28.0	84.0

[a,b] Percentages in the same column and muscle and trait group bearing a different superscript differ significantly ($P<0.05$).