

A NATIONAL SURVEY OF BEEF TENDERNESS IN FRANCE

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Abstract — Tenderness is an important factor of beef quality. It is often considered as disappointing and irregular by french consumers, but so far, no french study has yet given the means to have a concrete vision of the tenderness based on consumer sensory panels. This is precisely the objective of this work. 4 beef cuts (sirloin, rump, knuckle and outside flat) and 4 industrial processed meat products (marinated beef, vacuum beef for consumer, thin beef for stone-grill and beef skewer) were collected in various retail outlets chosen to be as representative as possible of french people purchases. Then, a panel of 1440 consumers tasted them. The results show that consumers are satisfied with the tenderness of marinated beef, sirloin, vacuum beef and rump. Respectively, 87, 72, 69 and 62% of consumers rated their tenderness "good", "very good" or "excellent". The results are more reserved on skewers and knuckle (49 and 57% rated "good", "very good" or "excellent") and disappointing for the outside flat and thin beef for grill (32 and 31% rated "good", "very good" or "excellent"). It seems necessary to work on the improvement of the lower-rated products otherwise degrade the overall image of beef.

Index Terms — beef, consumer panel, retail, tenderness

I. INTRODUCTION

Tenderness is the major factor of beef quality. It is the main expectation expressed by consumers in many consumer satisfaction studies (Dransfield & Zamora, 1997; Grunert, Bredahl & Brunsø, 2004; Neely et al., 1998; Resurreccion, 2003). Because of the higher price of beef compared to other protein sources, the importance of a good eating experience is crucial to maintain or improve current beef buying trends. But quality of beef, and particularly tenderness, is often considered as disappointing and irregular by French consumers. It could be one of the reasons of the downward trend in beef consumption observed in France in recent years. In this context, the French meat Interprofession (Interbev) decided to set up a national study to have a concrete vision of consumers' perception of meat tenderness, like the "national tenderness surveys" conducted regularly in the United States, Australia or New Zealand (Bickerstaffe, Bekhit, Robertson, Roberts & Geesink, 2001; Brooks et al., 2000; Morgan et al., 1991; Safari, Channon, Hopkins, Hall & Van de Ven, 2002; Voges et al., 2007). Thus, the objective of this survey was to determine tenderness of French beef from retail outlets based on consumer sensory panels. Providing a benchmark for beef tenderness would allow the industry to identify where tenderness issues may still be improved.

II. MATERIALS AND METHODS

A. Sampling

From July 2008 to June 2009, 2594 retailed beef samples were collected in 6 cities in France. Cities sampled were Paris, Lille (North), Lyon (East-Central), Marseille (Southeast), Toulouse (Southwest) and Rennes (West). Each city was sampled twice: once in autumn / winter and once in spring / summer. Beef was bought in the four main retail outlets used by the French: hypermarket, supermarket, hard discount and butcher, taking into account their respective shares in the household meat purchases (44, 28, 6 and 21% respectively, (GEB, 2007)). All the main retail chains were sampled to cover the different supplying strategies. Finally, 126 butchers, 160 supermarkets (11 different chains), 94 hypermarkets (8 chains) and 107 hard discounts (9 chains) were sampled.

Two types of beef products were studied: 1) fresh meat with 4 cuts, 2 muscles known to be rather tender (sirloin and rump) and 2 muscles more heterogeneous and potentially less tender (knuckle and outside flat); 2) 4 industrial processed meat products: marinated beef, vacuum beef for consumer, thin beef for stone-grill and beef skewer. For fresh meat, for each cut, 40 steaks were collected in each city and for each period. So a total of 480 steaks of each muscle were tasted. For industrial products, because of their lower rate of in-store presence and the seasonal nature of some of them, only a maximum of 40 units were collected in each city. So a total of 240 units of marinated meat, 240

units of vacuum meat for consumer, 124 skewers and 70 units of thin meat for grill were tasted by consumers.

Samples were brought from retailers to sensory analysis laboratories under refrigerated conditions (4–8°C). They were kept in refrigerators (2–4°C) until the next day of purchase in store. Before cooking, steaks were removed from store packaging and all information available was recorded including origin, category of animals, breed type, packaging, brand designation, marketing claims, package weight and price. When multiple steaks were in a package, only one steak was used for the study.

B. Consumer surveys

In each city sampled, 240 adult panelists, regular consumers of beef enjoying the cooking medium rare, were recruited to taste the meat collected in the city. Panelists ($n = 1440$) were slightly more female (56% of women) than the French population (52% (INSEE, 2009)), included fewer elderly (8% of consumers over 65 years against 20% in the French population (INSEE, 2008)) and was overqualified.

Steaks were cooked on a professional double-sided electric grill (Sofraca, grooved Infragrill 10012). They were removed at an internal temperature of 58°C (medium rare cooking). They were cooked and eaten without seasoning or fat (except skewers cooked with peppers and bard). After cooking, each steak was cut into three cubes.

Steaks were served randomly to individual panelists in sensory booths. Each consumer received one cube of each sample and evaluated 6 samples during the session: 1 sample of sirloin, 1 sample of rump, 1 sample of knuckle, 1 sample of outside flat, and in autumn / winter, 1 sample of marinated meat and 1 sample of thin meat for grill, or in spring / summer, 1 sample of vacuum meat for consumer and 1 sample of skewer. Samples were evaluated in a sequential monadic testing. They were characterized using structured continuous scales of 100 mm (notes from 0 to 100) for overall like (from dislike to like extremely), tenderness (from not at all tender to very tender) and flavor (from insipid to very tasty). Overall like, tenderness and flavor were also classified into 8 classes: hateful, very bad, bad, insufficient, average, good, very good, famous. Consumers were asked if they wanted to consume again the tasted product.

C. Statistical analysis

For each sample, the scores of the 3 cubes tasted were averaged for overall like, tenderness and flavor. The results are based primarily on a descriptive analysis of data (means, standard deviations, distributions, Tukey box and whiskers plot) because of the size of the samples studied and their variability. Multivariate analyses were performed with SPAD 7.0.

III. RESULTS AND DISCUSSION

With 75% of tenderness scores over 60 (scores from 0 to 100) and an average score of 70, sirloin has emerged as the most tender of the 4 cuts tasted (Figure 1). Rump tenderness was also satisfying, with 50% of scores between 53 and 80 (first and third quartile), and an average score of 65. Knuckle scores were lower, with 25% of the scores below 42, 50% of the scores below 57, and an average score of 57. Finally, outside flat received the lowest rating by consumers for tenderness, with 50% of the scores below 45 and an average score of 45. A similar classification of cuts was observed with tenderness characterization on the 8 classes scale. Sirloin received highest ratings for tenderness: 72% of consumers rated it in the "good", "very good" or "excellent" tender classes (Table 1). Rump tenderness seemed also satisfying for consumers: 62% rated it in the "good", "very good" or "excellent" classes. Knuckle tenderness was more reserved: half of the jury rated it in the "good", "very good" or "excellent" classes. For outside flat, less than a third of the jury rated it in the "good", "very good" or "excellent" classes. Tenderness ranking of these cuts was expected and confirms the results of the USA tenderness surveys (Morgan et al., 1991; Brooks et al., 2000; Voges et al., 2007).

With 75% of tenderness scores over 75 and an average score of 80, the marinated beef emerged as the tenderest industrial products (Figure 2). Moreover, the tenderness variability of this product seemed relatively low, with only 17% between the first and third quartiles. Vacuum beef tenderness scored slightly lower, with an average score of 69. The tenderness scores of skewers were a bit below, but still 50% exceeded 65, with an average score of 60. With 75% of tenderness scores below 50 and an average score of 43, thin beef for grill was the less tender product. The ranking was similar with the 8 classes scale. Respectively, 87, 69, 55 and 32% of consumers rated the tenderness of marinated beef, vacuum beef, skewers and thin beef for grill in the "good", "very good" or "excellent" tender classes (Table 1).

Very similar results, with the same ranking, were observed for flavor and overall like (Table 1). 85% of panelists intended to eat again marinated meats. In accordance with the scores of tenderness, flavor and overall like, marinated beef was the most satisfying product tested in this study. Sirloin, rump and vacuum beef for consumers were also satisfying. Nearly two-thirds of consumers have indicated their intention to consume them again. Vacuum beef and sirloin were however slightly better rated than rump (respectively, 72 and 69% for positive vs. 63%). Skewers and knuckle satisfaction has been more variable. Only half of the consumers intended to eat these products again. Outside flat and thin beef for grill products emerged as the most disappointing. Only one third of the panelists intended to eat them again (Table 1).

Results were very constant. No difference of ratings was observed between sampled cities or sampled periods. Furthermore, consumers' characteristics (gender, age, working status, professional category) did not appear as explanatory factors of ratings.

IV. CONCLUSION

The results of this study show that consumers are relatively satisfied with the tenderness of French beef from retail outlets. Marinated beef, sirloin, vacuum beef for consumer and rump seem quite satisfying. Ratings are more negative for knuckle and skewers and disappointing for outside flat and thin beef for stone-grill. For the first 4 products, these results can be used for beef promotion. On the other hand, it seems important for the industry to work to improve tenderness of the last 4 products, failing to degrade the overall image of beef. Increasing aging of muscles, marinating, mechanics tenderizing, may be considered for solutions to improve tenderness of these muscles.

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Figure 1. Distribution of tenderness scores of fresh beef cuts

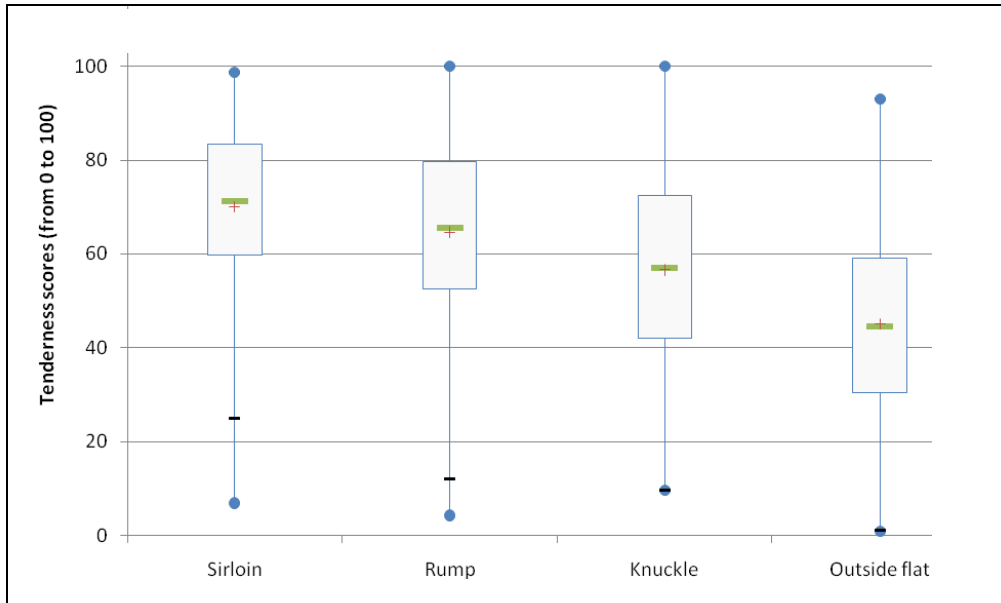


Figure 2. Distribution of tenderness scores of industrial beef products

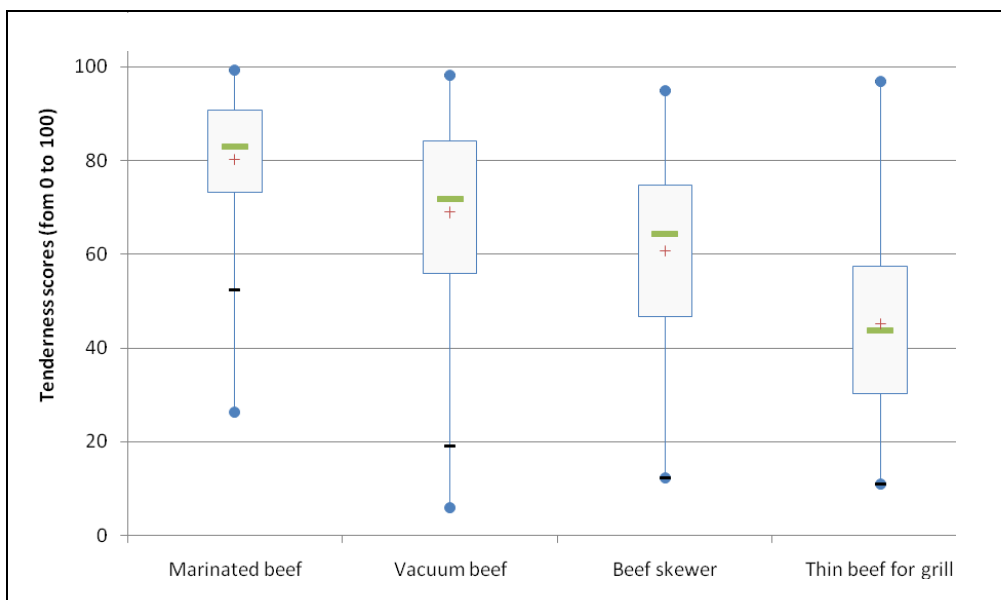


Table 1. Percentage of beef rated “good”, “very good” or “excellent” by the panelists

	Fresh beef cuts				Industrial beef products			
	Sirloin	Rump	Knuckle	Outside flat	Marinated beef	Vacuum beef	Beef skewer	Thin beef for grill
Rated “good”, “very good” or “excellent”								
in tenderness (%)	72%	62%	49%	32%	87%	69%	55%	32%
in flavor (%)	63%	60%	48%	37%	85%	70%	45%	27%
in overall like (%)	70%	63%	50%	34%	85%	71%	53%	32%
% consumers who want to consume the product again	69%	63%	49%	35%	85%	72%	49%	33%