



## CONSUMER'S PERCEPTION OF BEEF TENDERNESS

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### Background

Tenderness is considered the most important palatability characteristic of beef and, consequently, the primary determinant of meat quality (Dikeman, 1987). It is also very variable, depending on several factors related to genetics, nutrition, *ante mortem* handling and *post mortem* technological treatments. As outlined by Koochmaraie (1996), tenderness variability is the main reason for consumer's dissatisfaction. In fact, today, the consumer requires food with quality characteristics standardized and adequate to the price.

Beef tenderness can be evaluated studying their intrinsic characteristics by instrumental analysis or by sensory analysis, using a trained panel. However, it is very important, even if more difficult, to know consumer liking of tenderness, considering that the consumer is the user of the product.

### Objectives

The aim of this study was to determine consumer's ability to recognize differences in beef tenderness.

### Materials and methods

A consumer panel of 220 people differing in sex and age was recruited from a broad range of socioeconomic background (table 1). The males represented about 58% of the panel. Concerning age, the individuals were allotted in quite a homogeneous way into the first three classes (28% 18 to 30 yrs old; 27% <45 yrs old; 31% < 60 yrs old), while the individuals over 60 yrs represented about 14% of the panel.

Tenderness evaluation was performed on 31 samples of *longissimus thoracis* taken between the 8<sup>th</sup> and 10<sup>th</sup> thoracic vertebra from the right side of the carcasse. The animals belonged to the most widespread commercial categories in Piedmont: milkfed calves (C; n = 10) and young bulls. The latter included dairy (DB; n = 10) and beef breeds (BB; n = 11). Meat samples were purchased at retail and transferred to the laboratory of Department of Animal Science of Turin, where they were divided in two further samples, vacuum packaged, frozen and stored at -25°C until of their utilization. The samples were thawed at 2°C and then cooked by roasting in an electric convection oven, preheated at 210°C, until they reached a final internal temperature of 70°C. The cooking temperature was monitored by an Iron/constantan thermocouple connected to a thermometer and inserted into the geometric centre of the sample. The cooked meat was cut into 1.3 x 1.3 x 1.9 cm cubes for sensory analysis.

The tenderness sensory evaluation was carried out using a five point facial hedonic scale at the end-anchored by the words very tough/very tender (Cross *et al.*, 1986; AMSA, 1995). The scale was: 1 = "very tough"; 2 = "tough"; 3 = "neither tough nor tender"; 4 = "tender"; 5 = "very tender".

The sensory analysis was performed at the laboratory of the Department and, in general, in each session the panelists evaluated three samples, one of each animal's groups for a total of 671 evaluation. Each consumer was involved in only one session.

The correspondence analysis was employed to study the sensory judgements distribution in relation to either the sex and age of the consumers or the category of the animals (SPSS, 1997).

### Results and discussion

Table 2 shows that the distribution of the tenderness ratings was very similar in males and females (P = 0.75). Considering the consumers' age (table 3), a tendency of young people to give lower evaluations was observed, but the differences did not reach the level of significance (P = 0.49). Therefore the evaluation of beef tenderness seems not to be affected by consumer's sex and age. Similarly Huffman *et al.* (1996) did not observe significant effect of sex and age on sensory tenderness when the steaks were rated at restaurant, while reporting significant differences in tenderness rating across age groups in consumer's homes.

On the contrary, highly significant differences in rating distribution were observed according to the commercial categories of the animals (table 4; P < 0.001). Indeed, results show that meat of calves had scores



higher than meat of dairy ( $P < 0.001$ ) and beef ( $P < 0.001$ ) young bulls. The last two commercial categories did not differ in tenderness scores ( $P = 0.31$ ).

Figure 1 shows that calves obtained more ratings in highest tenderness classes. In fact, 45% “tender” meat (class 4) and 55% “very tender” meat (class 5) belonged to calves, which also had lowest percentages in “very tough” (class 1) and “tough” (class 2) meat. Although meat from young bulls showed similar tenderness ratings, it must be, however pointed out that meat from young bulls of dairy breeds represented more than 50% “very tough” tenderness rating, whereas meat from young bulls of beef breed had a higher percentage in “very tender” rating (28% vs 16%).

The overall results can be represented in the correspondence analysis plot (figure 2). The dimension 1 explained the largest amount of inertia (95%). The calves and rating 5, showing the highest deviation from the origin, gave the main contribution to the inertia of this dimension. The calves placed to the right in the plot and near to ratings 4 and 5 differed from the young bulls placed on the left and near to ratings 1, 2 and 3. In particular, dairy young bulls were the closest to rating 1, while beef young bulls were the closest to rating 2.

These results are in agreement with the data by Boleman *et al.* (1995), Huffman *et al.* (1996), Miller *et al.* (1995), Wheeler *et al.* (2002) indicating that the consumers can detect differences in tenderness.

## Conclusions

The results of this study show that, apart from sex and age, the consumers are able to consistently detect beef tenderness differences, when two commercial categories of animal are compared. In particular, ratings assigned by the consumers allowed to clearly discriminate the meat of calves from that of young bulls.

The large distribution of the meats of each commercial category of the animals in the tenderness ratings indicate that the meat sold at retail shows high variability. Consequently it is important for beef industry to promote the tender meat production.

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Table 1. Profile of consumer panelists for sex and age.

Sex	Age, yrs				Total
	18-30	<45	<60	>60	
Male	35	30	43	20	128
Female	27	29	26	10	92
Total	62	59	69	30	220

Table 2. Tenderness ratings by sex.

Sex	Tenderness ratings					Total
	1	2	3	4	5	
Male	32	89	94	116	59	390
Female	28	59	76	75	43	281
Total	60	148	170	191	102	671

Table 3. Tenderness ratings by age.

Age, yrs	Tenderness ratings					Total
	1	2	3	4	5	
18-30	19	48	52	43	26	188
<45	21	37	40	54	27	179
<60	14	48	51	65	34	212
>60	6	15	27	29	15	92
Total	60	148	170	191	102	671

Table 4. Tenderness ratings by commercial categories of animals.

Comm. Categories	Tenderness ratings					Total
	1	2	3	4	5	
C	4	27	36	86	56	209
DB	31	53	65	54	17	220
BB	25	68	69	51	29	242
Total	60	148	170	191	102	671

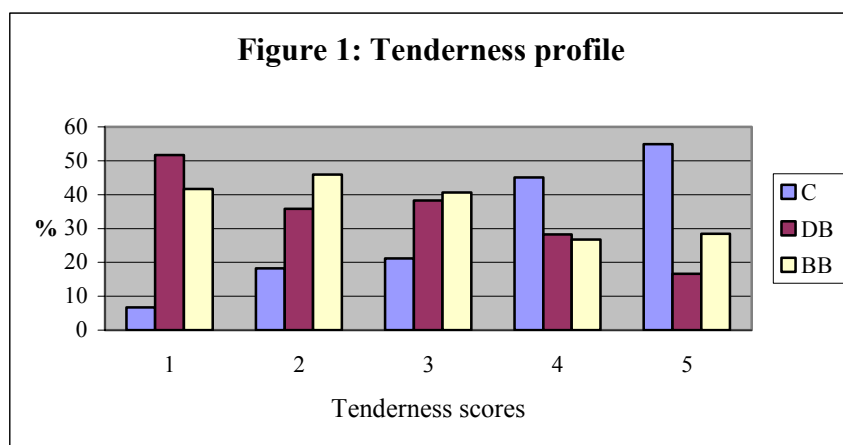




Figure 2: Plot of commercial categories and tenderness ratings

