Sensory Evaluation of Grain-fed versus Milk-fed Veal

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INTRODUCTION

The veal industry in Canada is primarily located in Quebec where traditionally dairy bull calves have been raised on a milk ration to about 100 Kg and then slaughtered. There is growing interest, primarily for economic reasons, in raising veal calves to a higher slaughter weight using a grain ration.

A number of studies have been published on the use of milk replacers in raising veal calves with considerable emphasis being placed on the use of fish protein concentrate as a replacement for milk (Gorrill et al., 1975; Huber, 1975; Dodsworth et al., 1977; Opstevedt and Hansen, 1977; Valin et al., 1977). Sensory aspects have received limited consideration in most of these studies. The current study was designed to study some sensory parameters of grain-fed versus milk-fed veal and in addition, to determine the effect of short-term frozen storage on the sensory quality.

MATERIAL AND METHODS

The animals in this study were handled through the normal production to retail chain. Milk-fed veal were placed in rearing barns 1-2 weeks post-birth and raised with a reconstituted milk diet to about 100 Kg live weight and then slaughtered. Grain-fed calves were raised on a decreasing milk formula for the first 5 weeks post-birth and then switched entirely to a grain ration of 16% protein. These calves were raised to a weight of about 200 Kg and then slaughtered as for the milk-fed calves. The carcasses were kept in cold storage for 4 days post-slaughter and then shipped to a retail store where roasts were obtained for the study. A total of 10 milk-fed and 10 grain-fed carcasses were utilized- 2 of each per week during a 5 week period. One loin roast (Longissimus dorsi) and 1 round roast (a combination of S. membranosus, S. tendinosus, Adductor and Biceps femoris) was obtained from each side of each carcass. The roasts from the right sides were evaluated fresh and those from the left sides were frozen and stored at -20°C for 4 months before being evaluated.

A ten member trained panel evaluated all roasts for raw and cooked color, flavor, juiciness, tenderness and overall acceptability. The roasts were cooked in standard domestic ovens at 162°C until an internal temperature of 70°C was reached. The sensory parameters were judged using the descriptive analysis method with scaling. Each judge recorded the perceived intensity of each parameter on unstructured, 15 cm lines with anchor points 1.5cm from each end. These markings were subsequently converted to numbers for statistical analysis. The descriptive terms assigned to the anchor points from left to right were as follows: color: beige - pink; flavor: mild veal flavor - mild beef flavor; juiciness: dry - juicy; tenderness: very tough - very tender; overall acceptability: poor-excellent.

Both sensory and instrumental raw color for rounds were determined on the Biceps femoris muscle. Cooked color and other sensory parameters for rounds were measured on the S. tendinosus. Warner Bratzler shear values for rounds were determined using the S. membranosus muscle. All loin measurements were made on raw or cooked L.dorsi muscle. Instrumental color was measured using a Hunterlab Color Difference Meter, Model D25-2 standardized with a white plate (L-92.2; a--1.1; b-0.7). All meat samples were twice ground through 1.6 mm plate before color measurements were made. Warner-Bratzler shear values were obtained on 1 cm cores of muscle samples using a modified Warner-Bratzler shear apparatus. Cooking loss and cooking rate were also determined for each roast. The pH of the fresh muscle samples was determined by blending 1g of muscle in 10 ml of distilled water and measuring with a pH meter standardized with both pH 4 and 7 buffers.

The frozen veal samples were analyzed in the same manner as described above. The roasts were thawed at 4°C for 48 hours prior to testing.

RESULTS AND DISCUSSION

The average carcass weights and muscle pH values are shown in Table 1. There were no significant pH differences between the two veal groups. The values for grain-fed animals however tended to be somewhat higher than for the milk-fed animals.

The means and standard error of means for sensory and instrumental parameters of the fresh veal samples are shown in Table 2. The raw color of both loin and round from grain-fed animals was judged to be more pink than those of milk-fed animals ($P \leq 0.05$). These differences were eliminated on cooking. No significant differences were found for flavor and juiciness. Grain-fed loins scored considerably higher than the milk-fed loins for flavor (7.74 vs 5.98) however no significance was found due to the considerable variation among animals within each group. Grain-fed rounds were found to be more tough than milk-fed rounds ($P \leq 0.01$) however this difference was not found to alter the overall acceptability which was similar for both group in both muscles. Even though the grain-fed rounds were judged tougher, the value 7.27 still is in the range for tender meat.

The Warner-Bratzler shear values were found to be significantly different ($P \leq 0.05$ loins and $P \leq 0.01$ rounds) with grain-fed samples being tougher in both muscles. Grain-fed rounds cooked at a faster rate than milk-fed rounds which is consistent with faster cooking rates for larger muscle portions. The difference in size between the two loins was not nearly as great as for the rounds thus no significant cooking rate was found. The cooking loss was greater for grain-fed muscles in both instances although the difference in rounds was not significant, again due to considerable variation within the groups. The color differences are consistent with the findings of Valin et al., 1977 who found that milk-fed calves had paler meat than those fed milk replacers. These

authors did not find significant tenderness differences however the veal size differences were not as great as those in this present study.

The data for the veal samples which were frozen and stored at 20°C for four months before evaluation are shown in Table 3. The freezing appears to have obviated some of the differences found for the fresh veal samples. The most significant finding was that freezing appeared to eliminate the color and tenderness differences. This may be due mainly to greater variations being found between muscles within a group. For tenderness of the loins, it may also be partially due to the greater cooking loss for frozen milk-fed loins versus the fresh milk-fed loins (18.44% vs 15.56%). The values for overall acceptability would appear to be the most pertinent and again both milk-fed and grain-fed were judged to be of equal acceptability with scores for the frozen samples being very similar to those for the fresh samples.

The instrumental color difference values are shown in Table 4. The only differences found were for the "a" values which pertain to the degree of redness of the samples. For the fresh samples both grain-fed loins and rounds were more red than their milk-fed counterparts. For the frozen samples, only the grain-fed rounds were more red than the milk-fed rounds. These instrumental values verify, for the most part, the sensory color findings.

In conclusion, it would appear that the sensory quality of grain-fed veal, raised to heavier weights than traditional milk-fed veal, is as acceptable as that for milk-fed veal. Freezing and storage at 20°C for four months also does not appear to significantly affect the eating quality of either grain-fed or milk-fed veal.

Table 1. Mean carcass weight and pH of loin and round muscle from grain-fed and milk-fed veal.

	Milk	Grain
Carcass weight (Kg)	55.2	94.5
pH (loin)	5.54	5.63
pH (round)	5.41	5.45

Table 2. Means and standard error of means for sensory and instrumental parameters of fresh grain-fed and milk-fed veal.

	Loin			Round		
Parameter	Milk	Grain	SE(mean)	Milk	Grain	SE(mean)
Raw colour	5.57*	9.19*	1.37	5.14*	9.01*	1.36
Cooked colour	4.58	5.20	0.56	5.78	6.30	0.51
Flavour	5.98	7.74	0.81	6.47	6.83	0.42
Juiciness	8.71	7.88	0.68	8.66	7.33	0.64
Tenderness	9.75	8.24	0.76	9.70**	7.27**	0.60
Acceptability	7.47	7.40	0.66	6.98	6.34	0.43
Warner Bratzler shear	990*	1614*	208.6	1129**	2131**	155.9
Cooking rate (min/100g)	8.67	8.66	0.32	9.97**	7.01**	0.56
Cooking loss (%)	15.56*	18.18*	0.11	20.79	25.01	0.20

* These means are significantly different P<0.05; ** P<0.01

Table 3. Means and standard error of means for sensory and instrumental parameters of frozen grain-fed and milk-fed veal.

	Loin			Round		
	Milk	Grain	SE(mean)	Milk	Grain	SE(mean)
Raw colour	5.66	9.59	1.71	6.38	9.23	1.71
Cooked colour	4.22	5.35	0.80	4.77	4.80	0.82
Flavour	7.08	7.54	0.45	7.33	7.74	0.90
Juiciness	8.23	7.74	0.73	7.55	6.94	1.09
Tenderness	9.39	9.21	0.78	8.26	6.78	0.75
Acceptability	7.77	7.95	0.77	6.90	6.34	0.50
Warner Bratzler shear	1616	1552	208.6	1318**	1872**	156.0
Cooking rate (min/100g)	10.91	9.62	0.72	10.97*	9.27*	0.70
Cooking loss (%)	18.44	18.35	0.14	26.77	27.24	0.18

*,** see Table 2

able 4. Hunter Color Difference values for fresh and frozen, raw and cooked grain-fed and milk-fed veal.

unter value		FRESH					
		Loin			Round		
		Milk	Grain	SE(mean)	Milk	Grain	SE(mean)
Raw	L	39.87	36.81	1.82	37.65	37.97	1.44
	a	10.49**	13.06**	0.58	12.09**	14.07**	0.60
	b	9.94	9.70	0.63	9.78	10.54	0.53
ooked	L	56.42	54.30	1.54	57.02	55.18	1.31
	a	3.59	4.13	0.32	3.88	4.27	0.33
	b	12.51	12.27	0.20	12.23	12.45	0.18
		FROZEN					
Raw	L	41.40	38.15	1.82	42.02	40.12	1.73
	a	13.62	15.60	0.94	11.50**	13.66**	0.60
	b	10.97	10.64	0.42	10.83	10.79	0.41
ooked	L	56.36	55.87	1.50	56.31	57.57	1.65
	a	4.53	5.01	0.34	4.65	4.17	0.35
	b	12.71	12.49	0.20	12.66	13.02	0.37

** see Table 2
L -degree of lightness
a -degree of redness
b -degree of yellow

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