COMPARISON OF CARCASS COMPOSITION OF "BOB" AND "SPECIAL FED" VEAL

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SUMMARY Carcass composition (muscle, fat, bone percentages) as well as values for proximate analysis and fatty acid profiles were obtained from 18 milk-fed calves Bob and 28 special-fed veal (SFV) calves. Bob veal had lower fat content (internal, external, intermuscular, and intramuscular), substantially more bone and slightly more moisture than SFV. Percent muscle and protein were slightly higher in SFV than in Bob veal. Retail cuts, fabricated from the left side of the SFV were worth $11.68 more than the right side by using innovative cutting procedures. Bob veal muscles contained less ($P < 0.05$) concentrations of fatty acids 14:0 and 18:2; but greater concentrations of 16:1, 18:0, 18:1 and 20:2 than SFV muscles. Monounsaturates were found to be in higher concentration in Bob veal. However, SFV had higher concentrations of polyunsaturated fatty acids. The overall polyunsaturated/saturated (P/S) ratios were 0.43 and 0.68 for Bob and SFV respectively. This investigation was conducted to provide data concerning carcass and nutrient composition as well as retail cutout information for two types of veal currently produced in the United States.

INTRODUCTION Veal is the meat derived from carcasses of immature bovine less than twenty weeks of age. Most of these calves are of dairy origin, usually Holstein bull calves. They are fed maternal milk or special formulated liquid diets often called milk replacers. Calves which are slaughtered at less than four weeks of age are referred to as Bob veal and weigh less than 57kgs. liveweight. Calves weighing 56.8kgs. to 140kgs. liveweight (4 to 12 weeks of age) are called vealers. Special-fed veal (SFV) originates from calves that are 16-20 weeks of age and have liveweights between 140kgs. and 227kgs. Kinsman (1989) reported that veal calves in the SFV classification are produced to meet the demand of the hotel-restaurant-institution trade for heavier veal which yields larger cuts.

Veal is a high protein and low fat meat that provides several B-vitamins as well as phosphorus, zinc and other essential minerals. Despite these nutritional qualities, the annual per capita consumption of veal (retail basis) in the United States has been less than two pounds for more than a decade (A.M.I.,1989). With the advent of the industry check-off programs, more dollars are available to support educational, research and promotional efforts for veal products. This may lead to an increase in demand and consumption.

Limited information (Moulton et al.,1922; Bray et al.,1959; Ono et al.,1986; Bowers et al.,1989; and Beauchemin et al., 1990) is available in the literature with respect to the carcass composition and nutrient content of veal. Therefore, this study was designed to develop a reference base on the cutability (Muscle-Fat-Bone ratio) of both Bob and SFV veal carcasses within specified weight ranges. Other objectives of this investigation were to ascertain the retail cutout values of saleable product; and to determine and compare free fatty acid profiles and the moisture, fat, protein, and ash content of selected muscles and primal cuts from Bob and SFV carcasses.

MATERIALS and METHODS

Carcass selection and physical measurements

Eighteen Bob veal and 28 SFV veal carcasses, within specified weight ranges, were obtained from J.G. Forte Inc. (North Branford, CT) and COPACO (Bloomfield, CT). Live weights, hide weights and hot carcasses weights were provided by the commercial packinghouses. All carcasses, originating from Holstein male calves, were delivered to the University of Connecticut Meat Laboratory.

Primal cut fabrication

Bob veal carcasses and the right side of SFV veal carcasses were divided into the foresaddle and the hindsaddle by cutting between the 11th and 12th ribs, with the 12th and 13th ribs remaining with the hindsaddle. Each quarter was fabricated into primals and weighed; external fat was removed to 0.32 cm thickness if such existed and each cut was reweighed. The trimmed primal cuts were boned and fabricated into sub-primals (round divided into the Adductor and Semimembranosus, Quadriceps femoris, Biceps femoris and Semitendinosus) and finally into individual muscles with caps, external fat and intermuscular fat removed. 10.2 cm tails were left on primal loins and racks according to the procedure outlined in the IMPS (1975). These cuts were reweighed with 5.1 cm tails and then again with zero tails. The same procedure was also used to fabricate all chuck rolls.

The left side of the SFV carcasses were divided into foresaddle and hindsaddle by cutting between the 12th and 13th rib, with the 13th rib remaining on the hindsaddle. The primal round was removed from the untrimmed loin and flank by cutting on the straight line which begins at a point along the backbone that is the juncture of the 5th sacral vertebra and the first caudal vertebra, and passes through a second point which is 2.5 cm anterior to the aitch bone. When this cut is made correctly, a piece of bone the size of a quarter is removed from the ball of the femur. The posterior ends of the Cutaneous trunci and the Rectus abdominous muscles were included with the primal flank. A 5.1 cm tail was left on the primal loin and racks. After all initial weights were obtained all primals were trimmed to 0.32 cm external fat thickness and reweighed. 5.1 cm tails were removed from the loins and flanks. Bones were removed from all primals, and the larger muscles were separated along natural seams so that they could be merchandized as intact roasts or sliced for cutlets. The

Triceps brachii and the Teres major were removed together from the primal chuck and merchandised as the shoulder clod. The Supra spinatius was also removed intact. The inside or bottom chuck which included the Subscapularis, Scalenus dorsalis, Serratus ventralis, Spinalis dorsi, Complexus and the Longismus dorsi muscles, initially had a 10.2 cm tail. This sub-primal was reweighed again with a 5.1 cm tail and again with a zero tail. The breast was removed from the primal chuck making a forty-five degree angle at the sternum and intercepting at the point where the 10.2 cm tail left on the rack separated the rack and breast. The short plate was separated from the breast between the 5th and 6th ribs. Short ribs were then sectioned from the plate by measuring 16.5 cm from the tip of the cartilage. External and intermuscular fat was removed from all primals, sub primals and individual muscles.

Chemical Analysis

AOAC (1984) methods were used to quantify moisture, protein, ash and fat at the Connecticut Agricultural Experiment Station Laboratory in New Haven, CT. Fatty acid profiles were obtained by direct transesterification gas-liquid chromatography according to the procedures cited in Journal of Lipid Research (Lepage and Roy, 1986).

Statistical Analysis

A two factor repeated measures analysis of variance (ANOVA) was used to compare group means (Bob and SFV), muscle means, and the group by muscle interaction. The SAS GLM procedure was used for the ANOVA and when necessary, follow-up pairwise comparisons of means were accomplished using the SAS LSMEAN option (SAS,1985). Both the within carcass coefficient of variation (CV) and the between carcass CV were computed (Steel and Torrie, 1980).

RESULTS and DISCUSSION Mean values for muscle, fat and bone for Bob and SFV are presented in Table 1. On a relative basis the percent muscle increased slightly (61.8% vs. 64.3%) when the carcass composition of Bob and SFV are compared. Percent fat, on the other hand more than doubled (6.6% vs. 14.8%) as age and weight of the veal carcass increased. Bone, the other major component of the veal carcass, decreased substantially (31.6% vs. 20.9%). A comparison of muscle, fat and bone composition with respect to the major primal cuts by veal types is also found in Table 1. With the exception of the breast and flank, all other primals increased in the proportion of lean. The breast and flank decreased 4.5% and 16.1% respectively in percent lean when Bob and SFV primals were compared. At the same time, the proportion of fat is 18.2% in the breast and 17.3% in the flank. These two primal cuts account for 15.6% of the total carcass fat in Bob veal and 33% in SFV.

The mean weights for the right and left sides were 52.8kg and 53.1kg respectively. When the retail cuts were fabricated from these sides according to methods previously discussed and assigned current market values (Table 2) the left side was worth $11.68 more than the right side. If the rack and shoulder of the left side were divided between the 4th and 5th rib rather than the 5th and 6th rib, the monetary value would be increased even more, as rack retail cuts are more valuable than shoulder roasts.

Four muscles per carcass (12 Bob and 13 SFV carcasses) were analyzed for moisture, protein, fat, and ash. The mean values for Bob and SFV carcasses are presented in Table 3. The proportion of protein and fat increased 1.3% (20.4% vs. 21.7%) and 1.2% (1.2% vs. 2.4%) respectively when the Bob and SFV carcasses were compared. Although, it could not be observed visually, the chemical analysis indicated that the proportion of intramuscular fat doubled in veal carcasses which differed in ages by 12-16 weeks. Simultaneously, percent moisture decreased from 75.5% in Bob veal to 73.1% in SFV. Similar findings were reported by Ono et al., (1986).

Fatty acid profiles for Bob and SFV are presented in Table 4. Statistical tests were obtained by analysis of variance where muscle was the repeated measures factor and Bob/SFV was the grouping factor. For each fatty acid, there was no significant interaction ($P > 0.05$) between the muscle and the group factor, indicating that the pattern of means across muscles was the same for both Bob and SFV. Only in the saturated fatty acid category was there a significant main effect of muscle. Examination of Table 4 indicated that this occurred because saturated fatty acids were higher for the Longissimus dorsi muscle, although only slightly higher in Bob veal. Also in Table 4, the differences between Bob and SFV were indicated by the overall means, an average over the four muscle groups since the interaction was not significant. The P-values for comparing the overall means are given in the last column. Bob veal contained significantly lesser percentages ($P < 0.05$) of 14:0 and 18:2, significantly greater percentages of 16:1, 18:0, 18:1, and 20:2, and non-significant differences were found for 15:0, 16:0, 17:0, 18:3, 20:3 and 20:4. Although the 15:0 fatty acid is not reported as one of the components of veal in the USDA Handbook 8-17 (1989), this investigation found 5.77% in Bob veal and 4.46% in SFV. A possible explanation for this may be bacterial contamination which occurred during the physical separation into muscle, fat and bone. This was conducted at room temperature and larger cuts were exposed to this temperature for several hours. The fatty acid analysis indicated that monounsaturates had a significantly higher concentration ($P < 0.01$) in Bob veal muscles than in SFV muscles (Table 4). The polyunsaturated fatty acid concentration, however, was higher ($P < 0.01$) for SFV than Bob veal muscles. The overall polyunsaturated/saturated (P/S) ratios for Bob veal is 0.43 and was significantly less ($P < 0.01$) than the SFV value of 0.68. Among the four muscles sampled, the lowest P/S ratio was 0.38 for Longissimus dorsi in the Bob veal group. The Biceps femoris and Semimembranosus muscle in the SFV group had the highest P/S ratio=0.75.

The average within carcass CV was 26.3% and the average between carcass CV was 24.2%, indicating that the variability from muscle to muscle within a carcass was similar to the variability of muscles from different carcasses. The moderately large CV's could explain why some of the larger muscle and group differences were not significant. (The within and between CV's for saturated fatty acid were, however, relatively low, being 7.1% and 5.8% respectively).

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TABLE 1
Carcass Composition of Bob and Special Fed Veal

PRIMALS	TYPE of VEAL	LEAN Kg.	LEAN %	FAT Kg.	FAT %	BONE Kg.	BONE %
FORE SHANK	B	0.92	44.7	0.14	6.8	1.0	48.5
	SFV	3.0	48.9	0.74	12.1	2.4	39.1
SHOULDER	B	3.7	64.8	0.41	7.2	1.6	28.0
	SFV	16.8	68.3	3.2	13.0	4.6	18.7
RACK	B	1.1	61.5	0.06	3.4	0.63	35.2
	SFV	3.2	64.4	1.06	13.1	1.84	22.8
BREAST	B	1.3	62.2	0.11	5.3	0.68	32.5
	SFV	5.4	57.7	2.2	23.5	1.76	18.8
FORESADDLE	B	7.02	63.6	0.72	6.5	3.31	30.0
	SFV	28.40	61.5	7.20	15.6	10.60	22.9
HIND SHANK	B	0.75	36.1	0.13	6.3	1.2	57.7
	SFV	2.60	48.3	0.58	10.8	2.2	40.9
ROUND	B	4.5	67.2	0.40	6.0	1.8	26.9
	SFV	20.4	74.5	2.6	9.5	4.4	16.1
LOIN	B	0.72	57.6	0.05	4.2	0.48	38.4
	SFV	3.2	61.8	0.62	12.0	1.36	26.3
FLANK	B	0.30	71.4	0.11	26.2	0.01	2.4
	SFV	2.8	55.3	2.2	43.5	0.06	1.2
HINDSADDLE	B	6.27	60.1	0.69	6.6	3.48	33.3
	SFV	29.0	67.4	6.00	13.9	8.02	18.6
CARCASS	B	13.29	61.8	1.41	6.6	6.79	31.6
	SFV	57.4	64.3	13.2	14.8	18.62	20.9

B=BOB VEAL
SFV=SPECIAL-FED VEAL

Table 2
Retail Product Yield and Value from SFV Sides

Cuts	Side	kg	$Value
BRISKET	LEFT	.71	4.70
	RIGHT		
SHORT RIBS	LEFT	1.62	10.70
	RIGHT		
SKIRT STKS.	LEFT	.43	2.82
	RIGHT		
RACK CUTLETS	RIGHT	1.62	17.82
RACK CUTLETS	LEFT	1.58	17.40
SHOULDER	RIGHT	4.32	28.52
SHOULDER	LEFT	5.00	32.98
ROUND ROASTS	RIGHT	4.52	49.81
ROUND ROASTS	LEFT	4.05	44.50
ROUND CUTLETS	RIGHT	5.67	62.33
ROUND CUTLETS	LEFT	5.36	59.00
TENDERLOIN	RIGHT	.52	8.53
TENDERLOIN	LEFT	.49	8.14
FLANK	RIGHT	.25	1.68
FLANK	LEFT	.26	1.69
LEAN TRIM	LEFT	13.84	20.76
LEAN TRIM	RIGHT	15.08	22.62
CARCASS	LEFT		202.68
	RIGHT		191.30

TABLE 3
Proximate Values for Bob and SFV Samples

PERCENT	BOB[1]	SFV[2]	DIFFERENCE
MOISTURE	75.51	73.08	2.43
PROTEIN	20.42	21.69	1.27
ASH	2.92	2.88	0.04
FAT	1.15	2.35	1.20

[1] 48 Samples, 4 Muscles, 12 Carcasses
[2] 52 Samples, 4 Muscles, 13 Carcasses

TABLE 4

Fatty Acid Profile % of Bob and SFV Muscles

Fatty Acids	Type of Veal	B.F.[1]	L.D.[2]	T.B.[3]	S.M.[4]	Overall Mean	P-values[9]
14:0	B	1.14	0.88	0.65	0.75	0.86	
	SFV	1.79	3.01	2.19	1.89	2.22	0.01
15:0	B	5.35	5.98	6.02	5.75	5.77	
	SFV	4.50	4.08	4.38	4.87	4.46	0.06
16:0	B	17.3	16.6	15.3	16.5	16.4	
	SFV	18.3	20.8	18.2	17.9	18.8	0.09
16:1	B	4.00	4.41	4.73	4.62	4.44	
	SFV	2.91	2.61	2.79	2.69	2.75	0.003
17:0	B	1.11	1.22	1.27	1.49	1.27	
	SFV	1.79	1.41	1.52	1.87	1.65	0.33
18:0	B	13.6	14.3	13.9	13.7	13.9	
	SFV	11.0	13.5	12.4	11.8	12.2	0.030
18:1	B	37.3	37.9	37.2	36.4	37.2	
	SFV	29.1	31.6	30.5	27.6	29.7	0.006
18:2	B	5.91	5.33	6.25	6.54	6.01	
	SFV	15.4	12.9	15.6	16.0	15.0	<0.0001
18:3	B	0.77	0.63	0.64	0.60	0.66	
	SFV	0.64	0.64	0.56	0.75	0.65	0.94
20:2	B	1.23	1.07	1.26	1.25	1.20	
	SFV	0.39	0.25	0.39	0.32	0.34	<0.0001
20:3	B	2.59	2.42	2.83	2.58	2.60	
	SFV	2.49	1.81	1.90	2.34	2.13	0.11
20:4	B	5.85	5.53	6.50	5.90	5.95	
	SFV	8.99	6.54	7.89	9.44	8.22	0.09
SAT[5,10]	B	38.6a	39.0a	37.1a	38.2a	38.2	
	SFV	37.4a	42.0b	38.6a	38.3a	39.3	0.40
MUFA[6]	B	41.3	42.4	41.9	41.0	41.6	
	SFV	32.0	34.2	33.3	30.3	32.5	0.01
PUFA[7]	B	16.4	15.0	17.5	16.9	16.4	
	SFV	27.9	22.0	26.0	28.0	26.3	0.003
P/S[8]	B	0.40	0.38	0.47	0.44	0.43	
	SFV	0.75	0.54	0.69	0.75	0.68	0.003

[1]=Biceps Femoris
[2]=Longissimus Dorsi
[3]=Triceps Brachii
[4]=Semimembranosus
[5]=Saturated Fatty Acids
[6]=Monounsaturated Fatty Acids
[7]=Polyunsaturated Fatty Acids
[8]=Ratio of Polyunsaturates to Saturates
[9]=P-values correspond to comparing the overall means for Bob and SFV.
[10]=Values with the same letter are not significantly different (P>0.05).