MEAT QUALITY AND LIPID COMPOSITION OF LOIN AND TOPSIDE FROM DAIRY-BEEF CROSSBRED YEARLING CALVES AND 2-YEAR-OLD STEERS

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I. INTRODUCTION

Livestock farming is challenged with finding alternative productions systems due to current impacts on animal welfare, the environment and climate change. Alternative farming systems in New Zealand are being considered by producing meat from crossbred surplus dairy calves finished on pasture at 8-12 months of age, to avoid slaughtering calves within 10 days of birth or to accelerate the cycle of beef production and lower its impacts on the environment compared with finishing animals at a later stage [1]. The aim of this study was to evaluate the quality and lipid composition of loin and topside from dairy-beef crossbred yearling calves and 2-year-old steers.

II. MATERIALS AND METHODS

Striploin (*M. longissimus lumborum*) and topside (*M. semimembranosus*) were obtained from yearling calves (n=12) and 2-year-old steers (n=12) of dairy-beef crossbred cattle finished on pasture. Meat samples were wet-aged at -1.5°C for 21 days (23 days post-mortem) then stored frozen at -20°C for up to one month. Samples were thawed at 0°C for 48 h and subsamples were taken for further anlyses. Meat pH values were measured using a portable pH probe. Instrumental colour (CIE L*, a* and b*) was measured at three random positions on freshly cut and bloomed surface of beef and veal steaks (2 cm thick) using Minolta Chroma Meter (CR-400). A 3 cm thick portion was placed in a plastic bag and cooked in a boiling water bath until core temperature of 75°C and cook loss was recorded. A minimum of ten cross sections (10 mm×10 mm) were obtained from each cooked steak and shear force (N) was measured by shearing perpendicular to the fibre axis direction using a texture analyser fitted with a Warner-Bratzler blade. Intramuscular fat (IMF) content and fatty acids (FA) profile of beef and veal samples were analysed following a direct trans-methylation method [2]. Fat-soluble vitamins (vitamin A and E, Lutein, β-carotene) were detemined based on the method by Nimalaratne *et al*. [3] with minor modifications. Data were analysed using R software and “lme4” and “predictmeans” packages. One-way ANOVA and Tukey’s honest significant difference were used to separate the means at P<0.05.

III. RESULTS AND DISCUSSION

Loins from yearling calves had slightly higher (P<0.05) pH than loins from 2-year-old steers, while pH was similar for topsides. Meat from yearling calves was less red and yellow with lower colour saturation index and higher hue angle (P<0.05) than meat from 2-year-old due to lower levels of myoglobin in meat from yearling animals. Meat from both types of animals had similar and low shear force values regardless of muscles, suggesting comparable tenderness and high-quality meat. Total fatty acids, %IMF and %MUFA were lower (P<0.05), while %PUFA, n-6 and n-3 PUFA were higher (P<0.05) in yearling calves, suggesting the higher degree of unsaturation in IMF of young beef compared to older animals. Although the PUFA:SFA ratio was higher in meat from yearling calves than 2-year-old cattle, all values were lower than the recommended ratio for a healthy diet (≥0.45). Both meat types had healthy n-6:n-3 ratios (≤4.0) while higher values were observed in topside from 2-year-old cattle than yearling calves. The levels of vitamin A and β-carotene were lower (P<0.05) in meat from yearling than 2-year-old cattle with no differences in vitamin E and lutein that may be due to the lower lipid content in meat from yearling calves.

Table 1 Meat quality traits, fat-soluble vitamins (mg/g meat), intramuscular fat (IMF) and fatty acid profile (g/100 g meat) of loin and topside from yearling and 2-year-old beef of crossbred dairy-beef cattle finished on pasture.

	Striploin				Topside			
	Yearling	2-year-old	*P*-values	SED	Yearling	2-year-old	*P*-values	SED
pH	5.57	5.51	0.004	0.02	5.51	5.50	0.310	0.01
*L** (lightness)	43.8	44.9	0.242	0.90	44.4	45.0	0.659	1.17
*a** (redness)	16.1	19.7	<0.001	0.66	19.0	23.0	<0.001	0.80
*b** (yellowness)	10.1	11.2	0.010	0.39	12.7	13.7	0.086	0.56
*C** (Chroma)	19.0	22.7	<0.001	0.73	22.9	26.8	<0.001	0.95
*h** (hue angle)	32.5	29.6	0.010	1.00	33.7	30.7	<0.001	0.54
%Cook loss	19.4	20.8	0.101	0.82	28.2	27.6	0.465	0.77
Shear force (N)	28.6	24.4	0.198	3.16	29.0	27.2	0.303	1.73
Fatty acids (g/100 g meat)								
Total FA	2.00	6.79	<0.001	0.54	1.83	3.71	<0.001	0.33
SFA	0.87	2.96	<0.001	0.24	0.72	1.51	<0.001	0.16
BCFA	0.03	0.10	<0.001	0.01	0.02	0.04	<0.001	0.00
MUFA	0.87	3.51	<0.001	0.31	0.81	1.91	<0.001	0.17
PUFA	0.22	0.21	0.293	0.01	0.27	0.25	0.025	0.01
n-6	0.11	0.10	0.013	0.01	0.13	0.13	0.299	0.01
n-3	0.07	0.06	0.013	0.00	0.09	0.07	<0.001	0.00
%IMF	2.37	7.59	<0.001	0.59	2.20	4.23	<0.001	0.36
%SFA	42.9	43.7	0.465	1.10	39.0	40.3	0.250	1.10
%BCFA	1.62	1.46	0.161	0.11	1.35	1.18	0.004	0.05
%MUFA	42.9	51.4	<0.001	1.13	43.5	51.4	<0.001	1.45
%PUFA	12.6	3.40	<0.001	1.37	16.2	7.09	<0.001	1.50
%n-6	6.25	1.54	<0.001	0.68	8.02	3.69	<0.001	0.76
%n-3	4.07	1.00	<0.001	0.46	5.17	1.99	<0.001	0.51
PUFA:SFA	0.29	0.08	<0.001	0.04	0.40	0.17	<0.001	0.04
n-6:n-3	1.54	1.52	0.741	0.07	1.57	1.84	<0.001	0.06
Fat-soluble vitamins (mg/g meat)								
Vitamin A	0.20	0.31	0.014	0.04	0.17	0.29	0.007	0.04
Vitamin E	0.56	0.62	0.636	0.12	0.56	0.54	0.757	0.07
Lutein	0.08	0.02	0.279	0.05	0.10	0.03	0.178	0.05
β-carotene	0.37	0.61	0.014	0.09	0.38	0.63	<0.001	0.06

IMF = intramuscular fat. SFA = saturated fatty acids = C10:0 + C12:0 + C14:0 + C15:0 + C16:0 + C17:0 + C18:0 + C20:0 + C24:0. BCFA = branched chain fatty acids = Iso-C15:0 + Anteiso-C15:0 + Iso-C16:0 + Iso-C17:0 + Anteiso-C17:0. MUFA = monounsaturated fatty acids = C14:1 + C16:1 + C17:1 + C18:1 *trans*-9 + C18:1 *trans*-11 + C18:1 *cis*-9 + C18:1 *cis*-11 + C24:1. PUFA = polyunsaturated fatty acids = C18:2 n-6 + C18:3 n-3 + CLA *cis*-9, *trans*-11 + C20:4 n-6 + C20:5 n-3 + C22:5 n-3 + C22:6 n-3. n-3 = Omega 3 PUFA = C18:3 n-3 + C20:5 n-3 + C22:6 n-3. n-6 = Omega 6 PUFA = C18:2 n-6 + C20:3 n-6 + C20:4 n-6. “%” was the percentage of fatty acid in total fatty acids.

IV. CONCLUSION

Loin and topside from yearling calves were lighter in colour, leaner and with similar cook loss and tenderness to those from 2-year-old steers. The lower IMF and higher %PUFA, %n-3 and PUFA:SFA ratio in meat from yearling calves can meet the growing demand for lean meat products, while contributing to mitigate issues related to animal welfare and the environmental impact of meat production.

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