DRY-AGING IMPACTS ON COLOR, FATTY ACID, AND LIPID OXIDATION OF STRIPLOIN FROM DAIRY CROSSBRED YEARLING AND 2-YEAR-OLD CATTLE

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I. INTRODUCTION

Producing beef from crossbred dairy surplus calves finished on pasture is an alternative farming strategy to reduce the environmental impacts of meat production and animal welfare concerns due to slaughtering bobby calves from the dairy industry [1]. Dry-aging is a value-adding strategy to produce high-quality beef with characteristic dry-aged meat flavor. It is unclear whether dry-aged meat from yearling animals have comparable quality and flavor intensity to older cattle. This study aimed to compare the impacts of in-bag dry-aging (BD) for 21 days on the color, fatty acids, and lipid oxidation of striploin from yearling and 2-year-old cattle.

II. MATERIALS AND METHODS

Twenty-four striploins (*M. longissimus lumborum*) were collected at 48 h post-mortem from dairy-beef crossbred yearling (~12 months old, n=12) and 2-year-old (n=12) cattle finished on pasture. Striploins were divided into four portions and assigned to BD (Tublin10®) for 0, 7, 14, and 21 days at 2 °C and 75% relative humidity. The weight losses during BD were recorded and pH was measured using a calibrated meat pH probe (Hanna 99,163 pH meter, USA). Instrumental color (CIE L*, a*, and b*) was measured on three random positions of freshly cut and bloomed (4 °C for 1 h) steaks using a calibrated Minolta Chroma Meter (CR-400, USA). Lipid oxidation level was estimated by the thiobarbituric acid reactive substances (TBARS) assay as described by Zhang [2]. TBARS results were presented as mg malondialdehyde (MDA) per kg dry matter to account for variations in moisture content. The fatty acids (FA) composition of aged samples was analyzed following a direct trans-methylation method by Agnew [3]. Major FA groups including straight-chain saturated FA (SC-SFA), branch-chain SFA (BC-SFA), monounsaturated FA (MUFA), polyunsaturated FA (PUFA), omega-3 FA (n-3), and omega-6 FA (n-6) were calculated and presented as the percentage in total FA. Data were analyzed using R software and “lme4” and “predictmeans” packages. Two-way ANOVA and Tukey’s honest significant difference (P<0.05) were used to determine any interactions between beef types and aging times.

III. RESULTS AND DISCUSSION

No interactions (P>0.05) were observed in most traits determined in this study between beef type and aging time except for TBARS (P=0.006) and BC-SFA (P=0.029). The pH values of striploins fluctuated throughout BD with significantly higher values observed in beef from yearlings than the 2-year-old after 0, 14, and 21 days of BD (Table 1). Meat color traits decreased while L* and hue angle tended to increase during BD in both meat types. Beef from yearling animals had darker, less red, and yellow color with lower color saturation index and hue angle following longer BD time compared to the older animals (P<0.01), probably due to the lower levels of myoglobin in beef from yearling animals and the higher weight loss during BD. However, there were no differences in hue angle after 21 days of BD. An increase of TBARS levels in samples from yearling animals (P<0.0001) was found after BD for 14 and 21 days with no significant changes from older animals during these times (P=0.093), indicating higher levels of lipid oxidation as BD progressed. Striploins from yearling animals had significantly lower percentages of MUFA, and SC-SFA, higher percentages of PUFA, n-3, and n-6, and similar BC-

SFA compared to older animals before BD. Most FA composition did not change after BD for 21 days compared to unaged equivalents (P>0.05) except for MUFA and BC-SFA. The decrease in BC-SFA (P=0.017) in beef from 2-year-old cattle may be due to the variations of fat content at different sample locations. The decrease of % MUFA (P=0.011) was only observed in yearling animals which could be linked to the increase of TBARS after 21 days of BD.

Table 1. Meat quality traits and lipid oxidation (TBARS, mg MDA/kg dry matter) of striploin from yearling and 2-year-old cattle during in-bag dry-aging for 21 days.

Traits	Yearling				2-year-old				Pr > F			
	Aging time (days)				Aging time (days)				Aging time (days)			
	0	7	14	21	0	7	14	21	0	7	14	21
% weight loss	-	17.53	27.26	29.70	-	12.90	19.89	22.90	-	***	***	***
pH	5.50	5.58	5.50	5.62	5.44	5.56	5.43	5.58	**	ns	**	*
*L** (lightness)	42.07	44.70	43.33	43.81	43.25	44.43	45.04	46.20	ns	ns	**	**
*a** (redness)	15.01	12.28	10.56	8.86	19.25	17.02	15.22	12.35	***	***	***	***
*b** (yellowness)	9.01	7.61	6.12	5.95	10.53	9.45	8.20	7.83	**	***	***	***
*C** (Chroma)	17.52	14.46	12.14	10.75	21.95	19.50	17.20	14.74	***	***	***	***
*h** (hue angle)	30.82	31.84	30.15	34.90	28.59	29.06	28.49	33.72	**	***	*	ns
TBARS	1.15	1.13	1.36	1.52	1.13	1.07	1.09	1.21	ns	ns	**	***

Levels of significance: * means <0.05; ** means <0.01; *** means <0.001. ns = not significant. Interaction between beef type and aging time was only observed for TBARS (P=0.006)

Table 2. Fatty acids (FA) composition (%) of striploin from yearling and 2-year-old cattle during in-bag dry-aging for 21 days.

	Yearling		2-year-old		Pr > F	
	Aging time (days)		Aging time (days)		Aging time (days)	
	0	21	0	21	0	21
Straight-chain Saturated FA	43.38	44.32	46.21	46.34	**	*
Branch-chain Saturated FA	1.38	1.45	1.31	1.18	ns	***
Monounsaturated FA	47.55	45.11	49.55	49.16	*	***
Polyunsaturated FA	7.68	9.13	2.93	3.32	***	***
Omega-3 FA	2.60	3.08	0.85	0.96	***	***
Omega-6 FA	3.49	4.24	1.36	1.60	***	***

Levels of significance: * means <0.05; ** means <0.01; *** means <0.001. ns = not significant. Interaction between beef type and aging time was only observed for Branch-chain Saturated FA (P=0.029)

IV. CONCLUSION

The dry-aging impacts on pH, color, and most FA groups were similar between yearling calves and 2-year-old cattle. Dry-aged beef from yearling calves had higher TBARS levels and % PUFA suggesting niche eating qualities and flavor profiles compared to mature cattle.

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