QUALITY EFFECTS OF BOK CHOY JUICE ON MARINATED PORK CHOPS

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I. INTRODUCTION

Marination is one of the most popular methods to enhance the flavour and appearance of lean meat. Marinade solutions can be found in various cultures using various levels of salt, spices, antioxidants, flavour enhancers, and seasoning herbs. Many vegetable-derived natural antioxidants could also be used as flavour enhancers. Several studies have investigated the use of alternative nitrate sources from vegetables to develop uncured meat products, while many previous studies also showed that natural nitrate from leafy greens negatively affects the flavour of meat products [1]. Therefore, it is important to find suitable vegetable sources with minimal undesirable vegetable aromas. One such candidate is bok choy, a widely consumed and popular vegetable in Asia, which has high nitrate content [2] as well as natural antioxidants and flavour enhancers. Therefore, the aim of this study was to investigate the effect on pork chop quality of marination with the juices of two types of bok choy, BCC (B. chinensis L. var. Chinensis) and BRC (B. rapa subsp. chinensis) on pork chop quality.

II. MATERIALS AND METHODS

Ten pork loins (5th to 10th ribs) were obtained from a local government-inspected slaughter plant on day 2 post-mortem and cut into 1.5-cm chops. Each of four marinades (CON, DW, BCC or BRC) was randomly applied to 20 pork chops. The control (CON) marinade contained 8% water, 1.5% sucrose, 1.5% soy sauce, 1.5% rice wine, 1.2% salt, 0.05% spice blend, 120ppm $NaNO_2$ and 500 ppm sodium ascorbate based on meat weight. The negative control (DW) marinade contained the same ingredients and amounts as CON, but no nitrite and ascorbate. The BCC and BRC treatment marinades contained 5% water, 3% vegetable juice from bok choy (BCC or BRC; fresh vegetable were blended to equal weight of cold distilled water in a Waring blender for 3 mins, the mixture was strained through cheesecloth to remove the pulp), and the same amounts of sucrose, soy sauce, rice wine, salt, and spice blend as DW. Each treatment was tumbled for 15 min at 15 rpm and held at 5°C for 24 h. Individual chops were then sealed in polypropylene bag and heated in a water bath at 85 °C until the internal temperature reached 71 °C. pH, cooking loss [3], objective colour features (L*, a* and b*), and sensory evaluation [1] were assessed in this study. Data were analysed using SAS 9.3 using split plot, mixed model procedure, P values < 0.05 were considered statistically significant.

III. RESULTS AND DISCUSSION

pH values of cooked BCC, BRC and DW pork chops were lower than CON ($P < 0.05$), but were not different among marinated chops. pH of marinated chops, as well as cooking loss, were not different ($P > 0.05$) among treatments (Table 1), which agrees with the results of Krause et al [4], who reported that the water-holding capacity of pork hams cured with vegetable juice powder and

those cured with sodium nitrite were not significantly different. Redness (a*) of marinated and cooked CON and DW chops was higher ($P < 0.05$) than in BCC and BRC chops (Table 2). Yellowness (b*) values were higher in cooked BCC (15.18±0.88) and BRC (14.13±0.91) chops resulted than in CON (10.49±0.86) and DW (13.03±0.24) chops, which is consistent with the results of Horsch et al [5], who found that high levels of vegetable pigments could affect the colour of the final meat product. The liking of flavour was significantly ($P < 0.05$) higher for CON, DW and BBC than for BRC ($P < 0.05$) treatments.

Table 1. pH, cooking loss and sensory analysis parameters[1] of pork chops.

		CON	DW	BCC	BRC	SEM	P-value
pH	Raw intact	5.88	5.90	5.82	5.79	0.04	0.616
	Marinated raw	6.03	5.92	5.82	5.80	0.06	0.347
	Marinated cooked	6.12^{b}	6.09^{ab}	5.90^{a}	5.85^{a}	0.04	0.002
Cooking Loss, %		24.9	24.5	26.0	25.5	0.32	0.602
Sensory evaluation	Texture[2]	10.9	10.6	9.95	9.75	0.40	0.821
	Tenderness[3]	9.65	10.1	9.85	8.95	0.30	0.563
	Flavour[2]	11.5^{b}	11.8^{b}	11.4^{b}	9.11^{a}	0.45	0.029
	Overall acceptance[2]	11.6	11.8	11.0	10.3	0.39	0.720

[1]Means in a row $^{a–b}$ between treatments without common superscripts within a measurement are different ($P < 0.05$)
[2]Chop evaluated on a 15-cm hedonic scale (1 = like the least, 15 = like the most).
[3]Chop evaluated on a 15-cm descriptive scale (1 = very tough, 15 = very tender).
SEM = Standard error of mean.

Table 2. Colour parameter of marinated raw and cooked pork chops.

		CON	DW	BCC	BRC	SEM	P-value
L*	Marinated chop[1]	36.4	37.0	36.6	40.3	0.55	0.648
	Cooked chop	59.1	61.0	62.7	63.1	0.67	0.171
a*	Marinated chop[1]	6.57^{b}	5.46^{a}	4.31^{a}	4.64^{a}	0.36	0.003
	Cooked chop	8.38^{b}	5.47^{a}	4.56^{a}	4.38^{a}	0.41	< 0.0001
b*	Marinated chop[1]	9.24	8.98	8.36	10.8	0.38	0.110
	Cooked chop	10.5^{a}	13.0^{b}	15.2^{c}	14.1^{c}	0.35	< 0.0002

[1] Measured after holding at 5°C for 24 h.
$^{a-c}$ Means in the same line with different letters are significantly different ($P < 0.05$).
SEM = Standard error of mean.

IV. CONCLUSION

BCC did not exert a negative impact on the flavour profile of pork chops, suggesting it has potential as a superior alternative to BRC as a flavour enhancer. Studies investigating shelf-life and colour development in cured meat using BCC should be conducted to further explore its potential as a natural source of antioxidants and nitrate in Chinese-style processed meat.

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