INHIBITION OF HETEROCYCLIC AROMATIC AMINES WITH CINNAMON AND CHINESE PRICKLY ASH FOR ROASTED MEAT

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I. INTRODUCTION

Roasted meat is always categorized as harmful for health due to the formation of certain carcinogenic compounds such as heterocyclic aromatic amines (HAAs) produced in meat at above 150ºC [1]. Spices such as cinnamon and Chinese prickly ash contain many antioxidant compounds which have potent antioxidant activity and may be beneficial to inhibit the formation of HAAs in roasted meat [2]. However, the inhibition of cinnamon and Chinese prickly ash on the formation of HAAs in roasted meat has not been well understood.

II. MATERIALS AND METHODS

The cinnamon and Chinese prickly ash were procured from a local market in Beijing, P.R China. The lamb oyster muscles without visible fat and connective tissue were ground through 5 mm plates into patty. 50 g paste was mixed with different content of Chinese prickly ash cinnamon (0.5%, 0.75%, 1%, 1.25%, 1.5%) and (0.5%, 0.75%, 1%, 1.25%, 1.5%) to form a patty. The patties were charcoal fire grilled for 15 min at 450˚C. A patty of charcoal fire grilled lamb without spice was taken as a blank. The antioxidant activity of the aqueous extracts of the spices was determined by the DPPH method. The contents of 20 kinds of HAAs in roasted meat were determined using LC-MS/MS. The data was statistically analyzed using SPSS 19.0. Differences between treatments were evaluated using one-way analysis of variance (ANOVA) followed by multiple comparison Turkey test.

III. RESULTS AND DISCUSSION

The results show that the Chinese prickly ash and Cinnamon have potent scavenging activity against DPPH, as the inhibition % value was from 85-90% for both spices at different concentrations from 10 μL/mL to 30 μL/mL. It showed that inhibiting effects of the two spices were similar to that of BHT which was a synthetic antioxidant with inhibition of 90-95%.

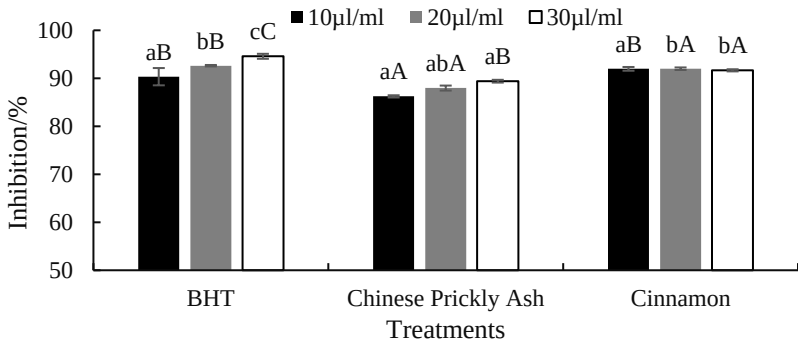

Figure 1. DPPH activity of BHT, Chinese prickly ash and Cinnamon.

Means with different lowercase letters as a function of different concentrations at every spice were significantly different ($P < 0.05$). Means with different capital letters as a function of different spices at the same concentration were significantly different ($P < 0.05$).

Table1 Heterocyclic Aromatic Amines content in roasted meat with Cinnamon and Chinese prickly ash

Treatments		DMIP	PHIP	Harman	Norharman	AaC
Control		38.00±5.11^{f}	13.11±2.26^{e}	17.41±2.92^{e}	14.58±1.38^{g}	2.92±0.57^{d}
CMN	0.5%	16.06±0.60^{e}	1.82±0.04^{d}	7.46±0.55^{c}	14.24±0.34^{f}	0.59±0.13^{bc}
	0.75%	12.87±1.49^{e}	1.45±0.08^{c}	5.32±0.86^{b}	10.32±0.76^{e}	0.35±0.08^{abc}
	1%	7.35±1.14^{c}	1.17±0.09^{abc}	3.23±0.34^{ab}	5.39±0.47^{d}	0.13±0.01^{ab}
	1.25%	3.45±0.89^{b}	0.68±0.12^{ab}	1.90±0.05^{ab}	2.89±0.40^{c}	0.08±0.02^{ab}
	1.5%	1.17±0.59^{a}	0.10±0.08^{a}	0.52±0.09^{a}	1.07±0.22^{ab}	0.02±0.01^{a}
CP	0.5%	21.26±1.28^{d}	4.14±0.29^{bc}	3.95±3.44^{d}	11.66±0.44^{g}	0.41±0.01^{c}
	0.75%	20.11±1.90^{cd}	2.24±0.08^{abc}	3.40±0.62^{c}	9.40±0.41^{f}	0.36±0.02^{abc}
	1%	12.25±1.82^{b}	1.39±0.16^{abc}	2.06±0.24^{b}	7.64±0.57^{c}	0.15±0.01^{ab}
	1.25%	7.69±2.26^{a}	0.64±0.16^{abc}	1.79±0.11^{ab}	5.29±0.93^{b}	0.06±0.01^{ab}
	1.5%	3.71±0.80^{a}	0.07±0.02^{a}	0.78±0.46^{a}	2.20±0.30^{a}	0.03±0.01^{a}

Means with different lowercase letters were significantly different ($P < 0.05$). CMN means Cinnamon, and CP means Chinese Prickly Ash.

The results of HAAs demonstrated that the cinnamon and Chinese prickly ash had inhibiting effects on the formation of five kinds of HAAs which were detected and other 15 kinds of HAAs (MeAaC, 4,8-DiMeIQx, 7,8-Di MeIQx, IFP, Glu-P-1, Glu-P-2, IQ, IQx, ISO-IQ (4,5-b), ISO-IQ, TrP-P-1, TrP-P-2, Phe-P-1, MeIQ, 8MeIQx) have not been detected in the samples. The control without spices showed that there is high amount of HAAs in roasted meat than the cinnamon and Chinese prickly ash treatment groups. Previous studies have suggested that antioxidant activity of spices is concentration dependent. Therefore current study proved that the formation of HAAs have been inhibited with increasing concentrations of the two spices in roasted meat.

IV. CONCLUSION

The research concluded that Chinese prickly ash and Cinnamon can be utilized as natural replacements against synthetic antioxidants to prevent the formation of HAAs in roasted meat and improve the safety of processed meat products.

ACKNOWLEDGEMENTS

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2-amino-1,6-dimethylimidazo[4,5-b]pyridine (DMIP), 2-aminodipyrido[1,2-a:3',2'-d]imidazole (Glu-P-2),
2-amino-1-methylimidazo[4,5-f]quinoline (iso-IQ), 2-amino-3-methylimidazo[4,5-f]quinoline (IQ),
2-amino-3-methyl-3H-imidazo[4,5-f]quinoxaline (IQx), 2-amino-3,4-dimethylimidazo[4,5-f]quinoline (MeIQ),
2-amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole (Glu-P-1), 2-amino-3,8-dimethylimidazo[4,5-f]quinoxaline (8-MeIQx),
2-amino-1-methylimidazo[4,5-b]quinoline (IQ[4,5-b]), 2-amino-1,6-dimethylfuro[3,2-e]imidazo[4,5-b]pyridine (IFP),
2-amino-3,7,8-trimethylimidazo[4,5-f]quinoxaline (7,8-DiMeIQx), 1-methyl-9H-pyrido[3,4-b]indole (Harman),
2-amino-3,4,8-trimethylimidazo[4,5-f]quinoxaline (4,8-DiMeIQx), 9H-pyrido[3,4-b]indole (Norharman),
2-amino-5-phenylpyridine (Phe-P-1), 3-amino-1-methyl-5H-pyrido[4,3-b]indole (Trp-P-2),
2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP), 3-amino-1,4-dimethyl-5H-pyrido[4,3-b]indole (Trp-P-1),
2-amino-9H-pyrido[2,3-b]indole (AαC), 2-amino-3-methyl-9H-pyrido[2,3-b]indole (MeAαC).