Antioxidant Activity of *Prunus mume* Extract in Cooked Chicken Breast Meat

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Abstract

The antioxidant properties of methanolic extracts from the fruit of *Prunus mume* were determined in chicken breast meat systems. When *P. mume* extract (PM) was added to chicken breast meat, 2-thiobarbituric acid-reactive substances (TBARS) value at Day 3 was decreased by about 45% of the control. PM did not affect color of chicken meat compared to the control. The amounts of volatile aldehydes and hydrocarbons were significantly decreased by the addition of PM. Especially, hexanal was the most predominant volatile compound in the control taking up almost more than 50% of the total volatiles, and PM reduced the amount into 26% of the control meat at 3 days.

Keywords: *Prunus mume; extracts; chicken meat; antioxidant properties*

Introduction

Activated oxygen species such as superoxide, hydrogen peroxide, hydroxyl radical, and singlet oxygen may cause various disease state such as carcinogenesis, drug associated toxicity, inflammation, atherogenesis, and aging in aerobic organisms, as well as food deterioration (Ames *et al.*, 1993; Halliwell *et al.*, 1992; Horton *et al.*, 1987). Synthetic antioxidants, such as butylated hydroxyanisole, butylated hydroxytoluene, and tertiary butylhydroquinone, have been widely used in foods for preventing oxidation. However, the use of these synthetic antioxidants in foods is discouraged because of their potential toxicity (Buxiang *et al.*, 1997) and carcinogenicity (Hirose *et al.*, 1998). Natural antioxidants (Buxiang *et al.*, 1997; Bae *et al.*, 1997; Yen *et al.*, 1997; Larson *et al.*, 1988), such as flavonoids, tannins, coumarins, curcuminoids, xanthons, phenolics, and terpenoids, have been attracted special interest because they can remove free radicals, which may cause various diseases, carcinogenesis, and aging (Pokorny *et al.*, 1991).

The fruit of *Prunus mume* has been used as a traditional drug and healthy food in Asia. Currently, it is widely consumed throughout the world because of its possible health benefits (Utsunomiya *et al.*, 2002). Some polysaccharides of *P. mume* exhibited biological activities such as mitogenesis, activation of the alternative pathway of complement and activation of clot formation in human plasma (Dogasaki *et al.*, 1994), benzyl glucoside and chlorogenic acid from *P. mume* contributed to relieving the tension in model rats caused by ether stress (Hiroji *et al.*, 2004)..

Precooked poultry meat products are highly susceptible to lipid oxidation and produce off-odor volatiles, and the use of antioxidants is commonly required to retard oxidative quality deterioration during storage. The need for natural antioxidants is increasing in food and meat industries as consumers demand safer and more natural additives. Although a few plant extracts are widely used as safe antioxidants, their activities are not as strong as synthetic antioxidants such as BHA and BHT, and the manufacturing cost is relatively high (Addis *et al.*, 1992).

The objective of this research was to determine the effects of *Prunus mume* extract on the lipid oxidation, volatile compounds, and color changes in precooked aerobically packaged chicken breast meat during refrigerated storage.

Results and discussion

TBARS Values in Cooked Chicken Breast Meat

The methanol extract of *Prunus mume* (PM) showed antioxidant activity in cooked chicken breast meat (Table 1). As storage increased, the overall lipid oxidation was drastically accelerated due to the denatured structure of the meats by cooking and aerobic storage conditions. At 3 days of storage, PM had lower TBARS values than the control by about 45% and 25% respectively. Rosemary extracts showed greatest antioxidant activity in cooked chicken breast. It agrees to the previous results of rosemary extracts showing antioxidant activity in foods due to their high contents of phenolic compounds (e.g. Del Campo *et al.*, 2000; Güntensperger *et al.*, 1998).

The 80% methanolic extract and ethanolic extract from fruits of *P. mume* showed antioxidative and free radical scavenging activity (Kim *et al.*, 1997, Shim *et al.*, 2002). *P. mume* contains several flavonoids such as naringenin (Hasegawa, 1959), and rutin has been identified as one of antioxidant components of the fruit of *P. mume* (Han *et al.*, 2001). The antioxidant activity of *P. mume* might be derived from combination of lots of compounds.

Inhibition of Off-Odor Volatiles

The production of warmed over flavor is the most critical problem and the role of antioxidants is important in storing cooked meat. PM reduced effectively the off-odor volatiles in cooked chicken breast meat but produced newly a few volatiles that are supposed to be responsible for the unique PM odor. Considerable amount of total volatiles were reduced by the addition of PM or rosemary extracts. When volatile compounds related with lipid oxidation were compared, volatile aldehydes (propanal, pentanal, hexanal, and heptanal) and a few hydrocarbons (pentane, octane, and nonane) were significantly decreased by the addition of PM. Hexanal was the most predominant volatile compound in the control meat consisting of almost more than 50% of the total volatiles, and it was reduced into 40% of the control by the addition of PM on the beginning of storage. In general, hexanal was the most correlated compound with the TBARS values (e.g. Ahn *et al.*, 2000; Du *et al.*, 2001) in cooked meats and it can be a good indicator for lipid oxidation.

At day 1, the hexanal contents of the control chicken meat increased by about 2.7 times compared with the 0 day. The amounts of most volatile aldehydes in rosemary extract-treated samples were statistically lower than the PM. At day 3, antioxidant effects were mainly found in the rosemary extract and PM treatments (Table 4). These results express that the antioxidant effects of rosemary extract and PM could be maintained for 3 day of storage.

Conclusions

In conclusion, the lipid oxidation products in precooked chicken breast meat showed the antioxidant activities of *Prunus mume*. If more efficient ways are developed to increase the antioxidant activities by concentrating more antioxidant components and/or excluding the unnecessary portions, *Prunus mume* will become an excellent natural antioxidant source.

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Table 1. TBARS values of cooked chicken breast meat with the addition of rosemary extract, raw *Prunus mume* extract (PM1), and extract of *Prunus mume* after preparation of liquor (PM2) during refrigerated storage

(mg of MDA/kg of meat)

Storage	Treatment			
(day)	Control	Rosemary	PM	SEM
0	0.095az	0.055cz	0.078bz	0.003
1	0.530ay	0.098cy	0.382by	0.010
3	0.934ax	0.151cx	0.516bx	0.057
SEM	0.065	0.006	0.006	

[a]Different letter (a~d) within a row are significantly different ($P < 0.05$), n=4. Different letter within a column (x~z) with the same meat are significantly different ($P < 0.05$).

Table 2. Volatiles profile of cooked chicken Breast meat with addition of rosemary extract, raw *Prunus mume* extract (PM1), and extract of *Prunus mume* after preparation of liquor (PM2) at 0day

Total ion counts $\times 10^4$				
Compounds	Chicken breast meat			
	Control	Rosemary	PM	SEM
Hydrocarbons				
heptane	258a	45b	243a	53
hexane	86	110	118	8
octane	153ab	216a	80b	57
pentane	816a	323b	436b	11
toluene	0b	272a	0b	5
Carbonyls				
2-propanone	7554b	7279b	8703a	17
butanal	0	0	0	30
heptanal	72a	0b	0b	14
hexanal	10423a	650c	6262b	859
pentanal	822a	37c	450b	78
propanal	1345a	0c	719b	117
Others				
decane	93b	0c	167a	26
disulfide, dimethyl	273b	822a	290b	129
Total	21852a	9781c	17466b	1236

[a]Different letter (a~d) within a row are significantly different ($P < 0.05$), n=4

Table 3. Volatiles profile of cooked chicken Breast meat with addition of rosemary extract, raw *Prunus mume* extract (PM1), and extract of *Prunus mume* after preparation of liquor (PM2) at 1day

Total ion counts × 10^4				
Compounds	Chicken breast meat			
	Control	Rosemary	PM	SEM
Hydrocarbons				
heptane	474a	69c	266b	50
hexane	77a	0b	88a	14
octane	233	143	228	49
oxirane	106a	0c	36b	11
pentane	1835a	311c	1178b	123
toluene	79b	271a	23b	43
Carbonyls				
2-propanone	6727	7017	7460	193
butanal	0b	0b	93a	49
heptanal	288a	90b	207a	35
hexanal	28371a	6701c	23055b	1325
pentanal	2424a	456c	1770b	209
propanal	5106a	545c	3717b	307
Others				
disulfide, dimethyl	132	177	171	45
Total	481	360	572	109

[a]Different letter (a~c) within a row are significantly different ($P < 0.05$), n=4

Table 4. Volatiles profile of cooked chicken Breast meat with assition of rosemary extract, raw *Prunus mume* extract (PM1), and extract of *Prunus mume* after preparation of liquor (PM2) at 3day

Total ion counts × 10^4				
Compounds	Chicken breast meat			
	Control	Rosemary	PM	SEM
Hydrocarbons				
heptane	1103a	88c	4476bc	131
hexane	303a	99b	185b	25
octane	782a	175c	415b	71
oxirane	689a	0c	409b	62
pentane	3753a	366c	1978b	361
toluene	0c	234a	79b	18
Carbonyls				
2-heptanone	143a	0b	96a	28
2-propanone	5413b	5827b	6960a	298
butanal	480	156	424	114
heptanal	809a	199b	602a	88
hexanal	67623a	19500c	50370b	3469
pentanal	8710a	1473c	5178b	790
propanal	11688a	1527c	8572b	815
Others				
disulfide, dimethyl	733	708	758	165
Total	102226a	30348c	76537b	5755

[a]Different letter (a~b) within a row are significantly different ($P < 0.05$), n=4