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ANTIOXIDATIVE ACTIVITY OF GINGER AND CORIANDER IN COOKED PATTIES OF MACKEREL (*Scomber Scombrus*) DURING STORAGE

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ABSTRACT

This study was carried out to determine the potential effects of ginger and coriander on reducing lipid oxidation of cooked patties of Mackerel (Scomber scombrus) during refrigerated storage. Four treatments were used consisting of fish + coriander (1%), fish + ginger (1%), fish + ginger (0.5%) + coriander (0.5%) and fish only as a control. Lipid oxidation was evaluated based on the total lipid content, peroxide value and free fatty acid value. Samples were also sensory evaluated for rancid odor. From this study, antioxidant activity increased in the order of coriander < ginger + coriander < ginger, lipid oxidation increased in the order of coriander > ginger + coriander > ginger. From the observation for 12 days of refrigerated storage (4 °C), it was found that rancidity increased with storage period. The degree of rancid odor increased in the order of coriander > ginger + coriander > ginger.

Keywords: mackerel, oxidation, coriander, ginger

1. INTRODUCTION

One of the major causes of muscle food deterioration is oxidative rancidity. This oxidative deterioration of muscle involves the oxidation of the unsaturated fatty acids catalyzed by hemoproteins as well as by nonheme iron[1]. Oxidation of muscle foods occurs in the order of fish > poultry > pork > lamb[2]. The high lipid oxidation rate in fish may be attributed to the high degree of polyunsaturated fatty acids among others are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) as have been observed in herring fillets (*Clupea harengus*)[3].

The addition of synthetic antioxidants such as butylated hydroxyanisole (BHA), butylated hydroxyltoluene (BHT), and tertiary butylatedhydroquinone (TBHQ)

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can control lipid oxidation in foods. However, use of such compounds has been related to health risk resulting in strict regulations over their use in food product. This led to the use of natural antioxidants as the alternative to the synthetic ones.

The use of natural antioxidant offers several advantages. Natural antioxidants posses low or no toxicity, enhanced masking of off-flavor arising from oxidation and greater consumer acceptability as natural ingredients in foods[4,5].

Ginger or ginger extract has been shown to have strong antioxidant property[6,7]. According to Jitoe et al[8], curcuminoids are the principal antioxidant in ginger extract. Coriander also showed high antioxidative activity in juice[9]. Ginger and coriander contain phenolic compounds that perform the function of capturing free radicals and halting chain reaction[10]. Ginger and coriander may be potential antioxidant that can delay the occurrence of lipid oxidation in fish. Thus the objective of this project was to determine the potential use of ginger and coriander in reducing lipid oxidation in cooked patties of mackerel *(Scomber scombrus)*.

2. MATERIALS AND METHODS

2.1 Raw materials

Mackerel (*Scomber scombrus*) were purchased from Pasar Borong Selangor, Puchong and stored at –20 °C prior to used. Ginger (*Zingiber officinale*) and coriander *(Coriandrum sativum)* were bought at the local supermarket.

2.2 Chemicals

Potassium iodide, glacial acetic acid, chloroform and thiosulphate solution, diethyl ether, alcohol, phenolphthalein solution (1%), sodium hydroxide and hydrochloric acid.

2.2 Methods

Fish were degutted, deboned, washed thoroughly and then minced in a domestic mincer. Ginger extract and/or ground coriander was added into the mince meat in the following combinations : fish + coriander (1%), fish + ginger (1%), fish + coriander (0.5%) + ginger (0.5%) and fish only.

The minced meat was shaped into patties by using a Hollymatic patty maker. The patties were cooked in a convection oven at 160 °C for 30 minutes followed by cooling and storing at 4 °C. Observations were made every 3 days for 12 days in which the samples were analyzed every 3 days for 12 days period for total lipids[11], free fatty acids and peroxide value[12]. For the extraction of lipids for used for the determination of free fatty acids and peroxide value, 30 g of fish muscle were mixed with water, methanol and chloroform. The chloroform was evaporated to dryness using rotary evaporator followed by complete drying in an oven at 150 °C. The peroxide value was determined based on the volume of sodium thiosulphate needed to change the

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color of the solution using starch as an indicator. Peroxide value is reported as mEq/kg. Free fatty acids were determined after neutralization of diethyl ether and alcohol solution with NaOH using phenolphthalein as an indicator.

Samples were also sensory evaluated for the rancid odor using 25 untrained panelists consisting of students and staffs of Faculty of Applied Sciences, UiTM, Shah Alam. The scale for rancid odor was given as 1= absent, 2 = very slight, 3 = slight, 4 = moderate, 5 = strong, 6 = very strong. The collected data were analyzed by SAS [13].

3. RESULTS AND DISCUSSION

3.1 Total lipids (%)

Table 1 showed the total lipid content of cooked mackerel patties after treatment with ginger and or coriander. Neither treatment nor storage period significantly ($p>0.05$) affected the total lipid content.

3.2 Peroxide Value

In general, patties added with either ginger or coriander or combination of both have significantly ($p<0.05$) lower peroxide value than untreated patties (Table 2). Among the three treatments, patties containing ginger had significantly ($p<0.05$) lowest peroxide value. The peroxide value of patties treated with ginger was also significantly lower ($p<0.05$) than those that contained the combinations of ginger and coriander. As for the effect of storage period, it was found that peroxide value significantly increased ($p<0.05$) as the number of days increased.

3.3 Free fatty acid

The free fatty acid value in patties treated with ginger were significantly lower ($p<0.05$) than those treated with coriander or combination of ginger and coriander except on day 9 (Table 3). Similarly, patties treated with ginger alone have a significantly lower ($p<0.05$) free fatty acid than those treated with the combination of ginger and coriander. Free fatty acid values also increased significantly ($p<0.05$) with days of storage.

3.4 Sensory evaluation (rancid odor)

As shown in Table 4, the rancid odor increased with days of storage. This suggested that peroxide formation was slow at the beginning and needed longer storage duration for the formation of rancid odor. The rating for rancid odor, as evaluated by the panelists, was below 3 or slight for the treated samples. Thus, in terms of rancidity development the addition of ginger, coriander or the combinations may have prevented or slowed down the lipid oxidation. Sensory evaluation showed that rancid odor was significantly lower ($p<0.05$) in patties treated with ginger. Significantly lower ($p<0.05$) rancid odor was also observed in patties treated with ginger than those treated with combination of ginger and coriander.

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Table 1. Total lipids (%) of mackerel treated with ginger and / or coriander.

Days	F+G	F+C	F+G+C	F
0	3.779^{aA}	5.736^{aA}	5.150^{aA}	5.125^{aA}
3	3.109^{aA}	4.049^{aA}	4.527^{aA}	4.230^{aA}
6	3.370^{aA}	4.282^{aA}	3.369^{aA}	3.842^{aA}
9	4.385^{aA}	3.882^{aA}	4.068^{aA}	5.241^{aA}
12	3.881^{aA}	3.801^{aA}	3.934^{aA}	4.946^{aA}

Values represent means of three replicates.
Means within a row with different upper case are significantly different ($p< 0.05$).
Means within a column with different lower case are significantly different ($p< 0.05$)
F + G = Fish + Ginger, F + C = Fish + Coriander, F + G + C = Fish + Ginger + Coriander, F = Fish

Table 2. Peroxide Value (mEq/kg) of mackerel treated with ginger and/ or coriander.

Days	F+G	F+C	F+G+C	F
0	0.400^{eA}	0.360^{eA}	0.380^{eA}	0.400^{eA}
3	1.325^{dC}	1.610^{dB}	1.520^{dB}	2.190^{dA}
6	4.505^{cC}	5.000^{cAB}	5.000^{cB}	5.180^{cA}
9	6.760^{bD}	7.280^{bB}	7.070^{bC}	7.315^{bA}
12	7.535^{aC}	8.390^{aB}	8.010^{aB}	9.230^{aA}

Values represent means of three replicates.
Means within a row with different upper case are significantly different ($p< 0.05$).
Means within a column with different lower case are significantly different ($p< 0.05$)
F + G = Fish + Ginger, F + C = Fish + Coriander, F + G + C = Fish + Ginger + Coriander, F = Fish

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Table 3. Free Fatty Acid of mackerel treated with ginger and / or coriander.

Days	F+G	F+C	F+G+C	F
0	0.220^{eA}	0.220^{eA}	0.220^{eA}	0.220^{dA}
3	0.295^{dD}	0.390^{dB}	0.355^{dB}	0.455^{cA}
6	0.515^{cC}	0.680^{cAB}	0.590^{cAB}	0.870^{abA}
9	0.765^{bB}	0.895^{bAB}	0.790^{bB}	1.010^{abA}
12	0.850^{aC}	1.120^{aB}	0.980^{aB}	1.135^{aA}

Values represent means of three replicates.
Means within a row with different upper case are significantly different ($p< 0.05$).
Means within a column with different lower case are significantly different ($p< 0.05$)
F + G = Fish + Ginger, F + C = Fish + Coriander, F + G + C = Fish + Ginger + Coriander, F = Fish

Table 4. Sensory Evaluation of mackerel treated with ginger and / or coriander.

Days	F+G	F+C	F+G+C	F
0	$1.000^{d/A}$	$1.000^{d/A}$	$1.000^{d/A}$	$1.000^{d/A}$
3	$1.140^{c/B}$	$1.130^{d/B}$	$1.100^{d/B}$	$1.840^{c/A}$
6	$1.240^{c/C}$	$1.460^{c/B}$	$1.540^{c/B}$	$2.580^{b/A}$
9	$1.760^{b/B}$	$1.760^{b/B}$	$1.920^{b/B}$	$3.580^{a/A}$
12	$2.100^{a/C}$	$2.580^{a/B}$	$2.620^{a/B}$	$3.740^{a/A}$

Values represent means of three replicates.
Means within a row with different upper case are significantly different ($p< 0.05$).
Means within a column with different lower case are significantly different ($p< 0.05$)
F + G = Fish + Ginger, F + C = Fish + Coriander, F + G + C = Fish + Ginger + Coriander, F = Fish
Rancid odor scale : 1= absent, 2 = very slight, 3 = slight, 4 = moderate, 5 = strong, 6 = very strong.

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4. CONCLUSION

Oxidative rancidity is probably a more serious problem in fish than in other food due to the high level of polyunsaturated fatty acids and the number of potential initiators or promoters present. Mackerel was more susceptible to lipid oxidation due to its high levels of total lipids, total fatty acids and total unsaturated fatty acids and it is categorised in the medium oil group (5-15%)[14]. From this study, we can conclude that the oxidation of lipid in cooked patties of mackerel increased in the order of coriander > ginger + coriander > ginger. Ginger and coriander have the ability to retard lipid oxidation in mackerel cooked patties. As for the development of rancid odor, the degree of rancidity also increased in the order of coriander > ginger + coriander > ginger. The greater the lipid oxidation, the greater was the degree of rancid odor. Lipid oxidation also increased with storage period in both the treated and untreated samples. Thus from this study, it is found that ginger has a good antioxidant activity compared to coriander or combination of ginger and coriander in retarding lipid oxidation in mackerel cooked patties. A strong antioxidative activity of ginger rhizome has been similarly reported previously[7,15]. However, it has also been reported that the effectiveness of ginger in retarding the lipid oxidation is dependent on several factors such as pH, preparation methods and concentrations[7].

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