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Some Quality Parameters of Intermediate Moisture, Deep-Fried Mackerel (*Scomberomorus commersoni*, Lacepede)

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Key words: Water activity (a_w); Intermediate Moisture foods; humectant.

RINGKASAN

Ikan Tenggiri Lembapan Sederhana dirempahi dengan ramuan tempatan telah disediakan dengan kaedah rendaman daripada larutan akuas mengandungi PEG 200, asid sorbik dan BHA. Hasil ini digoreng pada suhu 190°C selama 3 dan 5 minit, menyebabkan aktiviti air (a_w) masing-masingnya 0.84 dan 0.80. Sifat-sifat kimia, fizikal dan deria telah diuji. Ikan Tenggiri Goreng Lembapan Sederhana umumnya di dapati boleh diterima.

SUMMARY

Intermediate Moisture Deep-fried Mackerel seasoned with local ingredients was prepared by infusion method from an aqueous solution containing PEG 200, sorbic acid and BHA. The products were deep-fried at 190°C for 3 and 4 minutes, resulting in water activity (a_w) of 0.84 and 0.80 respectively. Tests on chemical, physical and organoleptic properties were carried out. The Intermediate Moisutre Deep-fried Mackerel was found to be generally acceptable.

INTRODUCTION

Deep-fried Mackerel (*Scomberomorus commersoni*, Lacepede) is a familiar delicacy to all Malaysians. However, it has never been thought of as an example of an Intermediate Moisture Food (IMF). Research on the acceptability and stability of intermediate moisture fish is very limited except for a preliminary study by Collins and Yu (1975) where catfish was deep-fried to achieve a suitable a_w range and a more recent work by Dymsza and Silverman (1979).

In tradtional IMF for human consumption, the chemical activity of water is depressed either by salt or sugar. Recently, however, other humectants such as sorbitol and glycerol have been used to formulate IMF either by blending or infusion. More research is being done on the latter since IMF has been known to be susceptible to various degradative changes such as lipid oxidation, browning and microbial growth (Labuza, Tannenbaum and Karel, 1970). Humectants have been incorporated to lower a_w and thus control bacterial growth. Molds are more effectively inhibited by antimycotics. Antioxidants and better packaging materials have been widely recommended to overcome oxidative rancidity problems.

The objective of this study was to develop an Intermediate Moisture Deep-fried Mackerel by combining deep-frying and the use of selected solutes. This paper presents the chemical, physical and sensory characteristics of the product.

MATERIALS AND METHODS

Product Preparation

The ingredients used are shown in Table 1. A description of the method of preparation is outlined in Fig. 1. The control and infused samples were deep-fried in corn oil at 190°C for 3 and 5 minutes.

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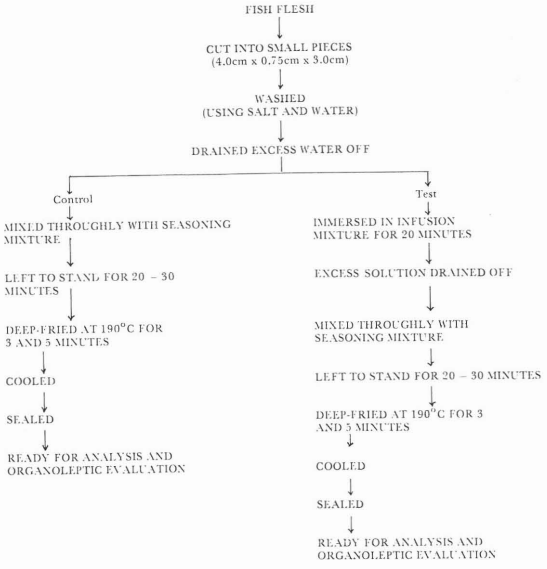

Fig. 1 Preparation of Intermediate Moisture, deep-fried Mackerel. (Atan, M. 1981).

TABLE 1
Ingredients used in the development of Intermediate Moisture, deep-fried Mackerel for 300 g flesh

Component	Ingredient	Amount
Fish flesh	Mackerel	300g
Infusion solution	Polyethelyne glycol (PEG) 200	2% (w/w)
	Sorbic acid	2% (w/w)
	Butylated Hydroxy Anisole (BHA)	4 ppm
	Distilled Water	100ml
Seasoning mixture	Turmeric powder	2g
	Garlic	1g
	Shallot	1.5g
	Red Chillies	1g
	Ginger	0.5g
	Wheat flour	4g
	Table Salt (NaCl)	2.5g
	Monosodium Glutamate (MSG)	0.1g

a_w *Determination*

a_w was determined by the chemical dessication method. Control and infused samples were placed in vacuum dessicators containing different saturated salt solutions and allowed to equilibrate at 29°C for 24 hours. Values obtained were interpreted by means of the graphical interpolation technique (Jayaratnam *et al.*, 1977).

Chemical Analysis

Moisture, crude protein and ash were determined by the AOAC methods (1975). Crude fat was determined by the chloroform-methanol extraction method (Pearson, 1976).

Physical Analysis

Colour was measured on the external portion of the cooked samples using the Hunter-lab Colormeter Model D25A-2 (A 4330). The instrument was standardized against a pink colour tile where 'L' (lightness) = + 67.3 'a' (redness) = + 22.6 and 'b' (yellowness) = + 11.4. Texture of the samples was determined using the Kramer Multiple blade cell attached to the Instron Universal Testing Machine (Model 1140). Firmness of the sample was expressed in kilogram of force required to shear the sample by a single downward action of the shear blade.

Organoleptic Evaluation

Samples were evaluated for preferences of flavour, colour, firmness and overall acceptability by a 10 member semi-trained panel comprising of adult males and females from the Faculty of Food Science and Technology on an 8-point hedonic scale (1 = extremely undesirable; 8 = extremely desirable). Samples were coded with three digits in a randomised arrangement to equalise the sample sequence effect on food preference.

Statistical Analysis

All data were analysed by the analysis of variance. Significance among the means was determined by the LSD test (Larmond, 1977).

RESULTS AND DISCUSSION

Figures 2 shows the sorption isotherm curves of control and infused samples obtained after the samples were placed in equilibrium at 29°C for 24 hours. The infused samples containing the humectant polyethylene glycol (PEG) 200, butylated hydroxy anisole (BHA) and sorbic acid had lower a_w's than the control samples. The humectant binds the available free water thus reducing the a_w of the product. The a_w obtained from the infused samples fried for 3 and 5 minutes were 0.84 and 0.80, respectively, while those of the control were 0.90 and 0.83, respectively.

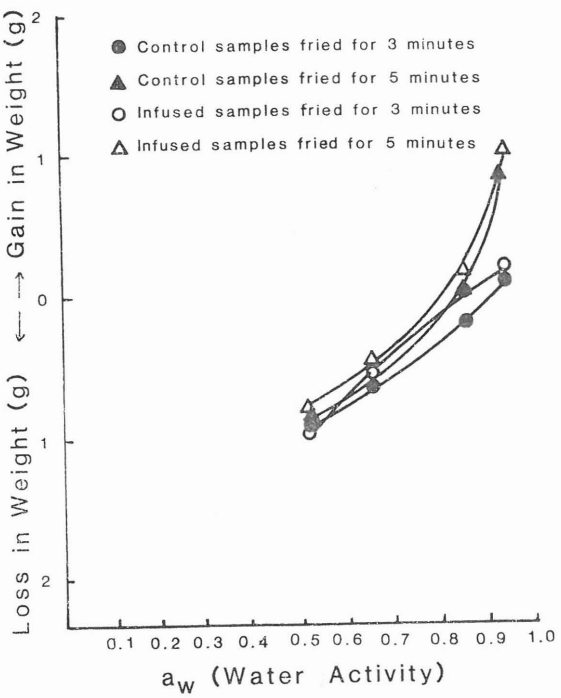

Fig. 2. Graphical Interpolation Isotherm of Intermediate Moisutre Deep-fried Mackerel for Control and Infused Samples.

Table 2 presents mean values for moisture, crude protein, crude fat and ash content of the control and infused samples immediately after frying. Data for raw samples were also included for comparison.

The mean Hunter colour 'L', 'a' and 'b' values are presented in Table 3. There were significant differences in the values except for Hunter 'a' values from control samples. The Hunter 'L' values decreased ($P < 0.01$) with prolonged heating in both the control and infused samples. Hunter 'a' values for the control samples were not significantly different ($P < 0.05$) : however, in the infused samples the 'a' values increased significantly ($P < 0.01$) indicating an increase in red colouration. The Hunter 'b' values also showed a significant decrease ($P < 0.01$) as frying time was increased. This indicates the loss of yellow colouration with severe heat treatment. In general, with a milder heat treatment (3 minutes) samples were orange-red; with a more severe heat treatment (5 minutes) samples were reddish brown and lost much of their yellow colouration.

Table 4 shows the mean values for firmness in kilogram force. The samples which were deep-fried for 5 minutes were significantly firmer or harder ($p < 0.01$) in the control and the infused samples. Firmness increased steadily with decreased a_w.

Table 5 shows the mean panel scores for organoleptic evaluation of samples as affected by different treatments. There was no significant difference observed due to frying effect for all attributes except for firmness ($P < 0.01$). Flavour and overall acceptability reduced significantly ($P < 0.01$) between the control and infused samples. There was no significant difference for colour between the two treatments. However, for firmness, there was a similar trend for both treatments with better acceptability at shorter frying times ($P < 0.01$). Generally, the panelists prefered samples which were not immersed in the infusion solution, that is, the control samples.

CONCLUSION

This study indicates that the flesh of Mackerel can be prepared as an intermediate moisture product with moderate acceptance. However, more work needs to be done to improve the product in order to increase its acceptability for future market demand. Storage studies also need to be carried out to determine the stability of the new product.

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TABLE 2
Proximate composition[1] of intermediate moisture, deep-fried Mackerel

Sample	Moisture	Crude Fate	Ash	Crude Protein
	Percent			
Raw Flesh	74.9 ± 0.90	4.0 ± 0.90	1.3 ± 0.29	15.9 ± 0.14
Control ; 3 min	57.4 ± 0.53	12.6 ± 0.45	2.5 ± 0.51	21.6 ± 0.72
Control ; 5 min	48.9 ± 0.34	16.5 ± 0.07	3.4 ± 0.20	19.1 ± 0.93
Infused ; 3 min	53.6 ± 0.73	10.1 ± 0.48	1.9 ± 0.55	22.6 ± 0.82
Infused ; 5 min	48.7 ± 0.37	13.4 ± 0.20	3.2 ± 0.29	19.8 ± 0.43

[1]Mean of 9 observations with ± 1 Standard Deviation

TABLE 3
Means[1] for Hunter 'L, 'a' and 'b' colour values of intermediate moisture, deep-fried Mackerel

Samples ; frying time	L	'a'	'b'
	Scores		
Control ; 3 mins	38.23^{b}	10.23^{a}	18.93^{a}
Control ; 5 mins	29.86^{d}	10.90^{a}	13.40^{c}
Infused ; 3 mins	41.13^{a}	6.20^{b}	19.66^{a}
Infused ; 5 mins	33.23^{c}	11.13^{a}	17.90^{b}

[1]Mean of 9 observations

[a-d]Mean within a column with different superscripts are significantly different (P 0.01)

TABLE 4
Mean[1] for Instron firmness values of intermediate moisture, deep-fried Mackerel

Samples ; frying time	Firmness (kilogram force)
Control ; 3 mins	54.08^{c}
Control ; 5 mins	72.73^{b}
Infused ; 3 mins	38.74^{d}
Infused ; 5 mins	87.08^{a}

[1]Mean of 6 observations

[a-d]Mean with different superscripts are significantly different (P 0.01)

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TABLE 5
Mean[1] Panel Scores for the different treatments on flavour, colour, firmness and overall acceptability of intermediate moisture, deep-fried Mackerel.

Samples, frying time	Flavour	Colour	Firmness	Overall Acceptability
	Scores			
Control ; 3 mins	5.5^{a}	5.9^{a}	6.1^{a}	6.2^{a}
Control ; 5 mins	6.1^{a}	5.4^{a}	4.7^{b}	6.2^{a}
Infused ; 3 mins	5.0^{b}	6.1^{a}	5.9^{a}	5.4^{b}
Infused ; 5 mins	4.5^{b}	5.9^{a}	4.7^{b}	5.2^{b}
F – Value	5.74^{**}	$1.59^{n.s.}$	14.51**	5.74^{**}

1Mean of 10 observations; Hedonic Scale : 8-extremely desirable and 1=extremely undesirable for flavour, Colour and Firmness ; 8=extremely acceptable and 1=extremely unacceptable for overall acceptability.

$^{a-b}$Pairs of mean within a column with different supperscripts are significantly different (P 0.01)

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