Journal of Coastal Development ISSN: 1410-5217
Volume 7, Number 3, June 2004 : 137-142 Accredited: 23a/DIKTI/Kep/2004

Original paper

THE EFFECT OF SMOKING DURATION ON THE QUALITY AND DHA COMPOSITION OF MILKFISH (*Chanos chanos* F)

*Fronthea Swastawati**

Fisheries Department, Diponegoro University, Semarang Indonesia

Received: April 19, 2004 ; Accepted: May 31, 2004

ABSTRACT

Milkfish contains omega-3 fatty acids (DHA), which is very important to maintain the health of human being. The research is mainly aimed to evaluate the reduction of DHA composition during smoking process. Organoleptic value of the product i.e. : 8,1 for fresh fish; 8,59 for smoked fish A (3 hrs smoking duration) and 8,78 for smoked fish B (5 hrs smoking duration). The composition of fish changes normally i.e. moisture content of 75,03% (fresh fish) decreases to 70,08% (A) and 68,11% (B). Protein composition increases from 20,30% (fresh fish) to 23,95% (A) and 27,50% (B). Lipid content increase from 0,61% (fresh fish) to 1,79% (A) and 3,53% (B). Ash content changes from 1,35% (fresh fish) to 2,03 (A) and 1,89% (B). SPSS analysis of DHA found of $p < 0,05$ means that A and B were significantly different. DHA content was found drastically decrease from 121,19 mg/100g (A) to 16,4 mg/100g (B). ANOVA result proved that there is an interaction between smoking duration and the composition of DHA. Smoking duration is recommended no longer than 3 hrs in order to maintain its quality and minimizing the reduction of DHA.

Key words: Smoking duration, quality, DHA, milkfish

***Correspondence**: Phone/Fax.: 024-8311525, E-mail: fronthea_s@yahoo

INTRODUCTION

Smoking is a method of preserving fish which involves some processes of 1) cooking, 2) drying, and 3) preservative value of the smoke, (Clucas and Ward, 1996).

Milkfish (*Chanos-chanos F*) contains high nutrition value and has a specific taste, therefore it is highly acceptable by Indonesian people (Swastawati, 1993). One of the most important compound that consist in milkfish flesh is omega-3 fatty acid, especially DHA (Dokosahexaenoic acid) which is useful in preventing the blood circulation diseases. Smoking of fish potentially causes the degradation and reduction of DHA composition in fish flesh depending on the duration of smoking (Burgess *et al.,*1965).

Omega-3 is useful to prevent the risk of diabetes disease, hypertension, cancer, and skin disease. Besides, omega-3 fatty acid, in this case DHA, is mostly found in brain, testicle tissue, and retina. It has important rules in taking care of eye sharpness, increasing the capability of learning and memory, preventing

rheumatic disease, and the existence of vitamin A is helpful to prevent blindness (Sunarya, 1990).

The fastest growth of brain cells of embryo occured on week 20th to week 36th of pregnancy period. It is required to pregnant woman to consume fish, especially sea water fish, in order that the needs of omega-3 fatty acid in helping the growth of embryo brain is optimally supplied (Harli, 1996).

Smoking of fish potentially causes the degradation and reduction of DHA composition in fish flesh depending on the duration of smoking (Burgess *et al.,*1965).

This research is aimed to investigate the effect of smoking duration to the quality and DHA composition of milkfish.

MATERIALS AND METHOD

Raw Material and Smoking Procedure

About 20 kg of Milkfish (±100 fishes) bought from Kobong Fishmarket, Semarang, were divided by two: one part was smoked for 3 hours and the other for 5 hours, the procedure is as follows :

1. Fish is scaled, gutted, and splitted then cleaned with water carefully.
2. Fish is brined for 20 min in 10% of salt then washed
3. Fish is dried to 75% of the dressed weight until the surface is dry and the fish reasonably firm
4. Fish is smoked at 40°C - 80°C for 3 hours (A treatment) and 5 hours (B treatment)

Analitical Methods

Sensory evaluation was objected to assess of appearance, colour, odour, taste and texture. Chemical analysis was conducted to observe protein, lipid, moisture and ash content of the product. DHA composition was measured by using Gas Chromatography.

Statistical Analysis

SPSS program was implemented to find the differences between treatments i.e. 3 hours and 5 hours smoking duration to the quality and DHA content. The treatment replicates 3 times. Interaction of two treatment was then evaluated by ANOVA.

RESULTS AND DISCUSSIONS

Sensory Evaluation of Raw Fish

Score Sheet of sensory evaluation used was based on Standar Nasional Indonesia, 1991. The result is presented in **Table 1**. Samples of raw materials used for study were generally of high organoleptic value with the characteristics of eyes perfectly fresh, convex black pupil, translucent cornea, bright red gills, no bacterial slime, outer slime water-white or transparent, bright opalescent sheen, no bleaching. Bluish translucent flesh, no reddening along the backbone and no discoloration of the belly flaps; kidney bright red. The fish was fresh 'seaweedy' odours with firm, elastic to the finger touch.

Table 1. Sensory Value of Raw Milkfish

Panelist	Specification				
	Eye	Gill	Belly	Texture	Average
1	8	7	8	7	7,5
2	8	8	8	9	8,25
3	8	7	7	8	7,5

4	9	8	9	8	8,5
5	8	8	9	9	8,5
6	9	8	8	9	8,5
7	8	7	8	8	7,5
8	8	8	9	8	8,25
9	8	7	7	9	7,5
10	9	8	9	7	8,5
Average	8,3	7,7	8,2	8,3	**8,1**

Organoleptic Value of Smoked Milkfish

Score Sheet the Organoleptic of Smoked Fish used was as recommended by SNI-01-2725-1992 and the result is presented in **Table 2** and **Table 3**.

Table 2. Organoleptic Value of Smoked Fish A (3 hrs smoking duration)

Panelist	Spesification						
	Appearance	Odour	Taste	Texture	Moulds	Slime	Average
1	7	7	7	9	9	9	8,83
2	7	9	9	9	9	9	8,83
3	9	7	7	7	9	9	8,66
4	7	9	9	9	9	9	8,66
5	7	9	7	9	9	9	8,33
6	9	9	9	7	9	9	8,83
7	9	7	7	8	9	9	8,16
8	9	9	9	7	9	9	8,66
9	9	7	9	7	9	9	8,33
10	9	9	7	9	9	9	8,66
Rerata	9	8,4	7,8	9	9	9	**8,59**

Both samples of smoked fish (A and B) seem to get a high degree of aceptability, for general quality, as they have a specific attribute of colour, texture and flavour intensity. Sample A has a little bit lower average value than that of sample B. This is due to the colour of smoked fish B which has a darker brown colour with a stronger specific smoky taste. The darker colour of sample B is caused by smoking particles stuck on sample B longer (5 hours) than sample A (3 hours). This means that the longer the smoking duration, the more smoking particles are produced and stuck on flesh, especially phenolic, which causes darker colour on sample B. According to Clucas and Ward (1996), chemical compounds of smoke important in the deposition process during smoking are acetic acid, formic acid and other acidic compounds. Phenolic (guaiacol, 4 metil-guaiacol, 2,6 dimetoksifenol) has produced specific flavour and odour with a delicious smoky taste (Pearson and Tauber, 1973). According to Swastawati (2003), the range of phenolic compound of smoked fish A (3 hours) is 1,59 to 1,69 while smoked fish B (5 hours) is 8,9 to 9,4.

Table 3. Organoleptic Value of Smoked Fish B (5 hrs smoking duration)

Panelist	Spesification						
	Appearance	Odour	Taste	Texture	Moulds	Slime	Average
1	9	8	9	9	9	9	8,83
2	9	8	9	9	9	9	8,83
3	9	9	7	9	9	9	8,66
4	9	7	9	9	9	9	8,66
5	9	7	7	9	9	9	8,33
6	9	9	8	9	9	9	8,83
7	9	9	7	9	9	9	8,66
8	9	9	8	9	9	9	8,83
9	9	9	7	9	9	9	8,67
10	9	9	7	9	9	9	8,67
Average	9	8,4	7,8	9	9	9	**8,78**

Proximate Analysis

The result of proximate analysis and its reference can be seen in **Table 4**. The data seems reasonable, eventhough the lipid content of the sample is lower but it depends on the weather where the fish was catched.

Table 4. Proximate Composition of Raw MilkFish

Parameter	Percentage (%)				
	Raw Fish	Ref: Rab 1997	Smoked Fish A	Smoked Fish B	Ref : Swastawati, 2003
Moisture	75,03	74,8	68,11	68,50	68,33
Protein	20,30	19	27,50	27,68	27,23
Lipid	0,61	5,0	3,53	3,56	2,98
Ash	1,35	1,2	1,89	1,97	2,02

Chemical composition of fish varies depending on species, sex, age, season and environmental condition where they were being catches (Ilyas, 1972). In this study, raw material is taken from Kobong fish market, caught in fishing area around Semarang.

Fatty Acids Analysis

Omega-3 fatty acid is better known as Docosahexaenoic acid (DHA) and Eicosapentaenoic acid (EPA). **Table 5** shows the result of fatty acid content in the product.

Table 5. Fatty acids Profile of Smoked Fish

		Unity (g/100g)

No.	Fatty acids	Smoked Fish A	Smoked Fish B
1.	Miristic acid C14 : 0	279,90	54,0
2.	Palmitic acid C16 : 0	3826,09	595,3
3.	Palmitoleic acid C16 : 1	672,09	187,2
4.	Stearic acid C18 : 0	433,86	60,8
5.	Oleic acid C18 : 1	6706,36	626,7
6.	Linoleic acid C18 : 2	446,90	101,1
7.	Linolenic acid C 18 : 3	1071,31	24,8
8.	EPA	46,38	37,4
9.	**DHA**	**121,19**	**16,4**

In this study, profile of fatty acid will be discussed especially focussing on the DHA composition.

The data shows that smoking duration can cause the reduction of fatty acid composition in general.

DHA composition was reduced very sharply about 86,46% or 104,79 mg/100g during smoking process. SPSS result found F value 13617986 and $p < 0,01$; therefore it can be concluded that A and B were very signifficantly different.

F value of ANOVA is 9090169,7 with $p< 0,00$. This means that smoking duration has an effect on the reduction of omega-3 fatty acid content of fish. The longer the smoking duration, the lower the EPA and DHA compositions. It is needed to consider smoking duration in order to minimize "nutritional losses" of fish.

CONCLUSION

Smoking duration gives an effect on organoleptic value, proximate composition and DHA content of smoked fish. Smoking can also can cause the reduction and probably the degradation of fish nutrition including omega-3 fatty acid.

REFERENCES

Burgess, G.H.O. *et a.l* 1965. *Fish Handling and Processing*. Edinburgh, HMSO.

Clifford, M.N.; Tang, S.L. and Eyo, A.A. 1980. Smoking Foods. *Process and Biochemistry* (Journal). June/July.

Clucas, I.J. and A.R. Ward. 1996. *Post Harvest Fisheries Development: A Guide to Handling, Preservation, Processing and Quality*. Chatham Maritime. United Kingdom.

Dewan Standarisasi Nasional. 1991. *Standar Nasional Indonesia untuk Ikan Segar*. Jakarta.

Harli, M. 1996. Konsumsi Ikan mengurangi penyakit degeneratif dalam Suratmo, S.B; E Putranti dan H Alifatimah

(Editors), *Buletin Sadar Pangan dan Gizi*. PT Indofood Sukses Makmur. Jakarta. 5 (1) : 2-3

Nettleton, J.A. 1995. *Omega-3 Fatty Acids and Health*. Chapman and Hall. New York.

Pearson, A.M. and F.W. Tauber. 1973. *Processed Meats*. Second Edition. Avi Publishing Company. Inc. Westport, Connecticut.

Rab, T. 1997. *Teknologi Hasil Perikanan*. Penerbit Universitas Islam Riau Press. Pekanbaru.

Sunarya. 1990. Masalah mutu tepung ikan rebon dan tepung kepala udang sebagai bahan baku pakan. Makalah *seminar Ilmu dan Teknologi Pakan Ikan/Udang*. Universitas Diponegoro. Semarang.

Swastawati. F. 1993. The Effecct of Smoke on The Proximate Composition And Microbial Aspect of Mackerel *(Scomber scombrus)*.

Swastawati. F. Titi Surti and Eka Purwaningsih. 2003. The effect of different concentration of salt and smoking duration to the quality and shelflife of milkfish. Proceeding of *JSPS International Seminar on Traditional Fisheries Technology in Asain Region*.

Tranggono. 1991. *Petunjuk Laboratorium "Analisa Lipida"* Pusat Antar Universitas Gizi dan Pangan Universitas Gajah Mada. Yogyakarta.

Winarno. F.G. 1993. *Pangan, Gizi, Teknologi dan Konsumen*. PT Gramedia Pustaka Utama. Jakarta.