

Contents of Histamine, Total Volatile Bases and Trimethylamine in Fresh Fish and Canned Fish Products

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A survey was made to determine seasonal variation of histamine, total volatile base and trimethylamine levels in a number of fresh fish and canned fish products as available through present distribution systems in Seoul area in order to assess potential danger of histamine poisoning related problems. Data obtained indicated that those products as available in present distribution systems should present no potential danger of histamine poisoning related problems.

Introduction

Even though there is no well documented case of histamine poisoning outbreak reported in Korea as yet from eating fresh fish and fishery products, the histamine poisoning related problems are well known in many countries where raw fish consumption is very high (Emerson *et al.*, 1964). To assess potential danger of histamine poisoning related problems, therefore, a survey was made to relate the histamine levels to the freshness of fresh fish and canned fish products sampled at retail stores in Seoul at different seasons.

Material and Methods

Survey on fresh and canned fish products

Various species of fresh fish, mackerel (*Scomber japonicus*), Spanish mackerel (*Scomberomorus maculatus*), saury (*Cololabis saira*), herring (*Clupea pallasii*), anchovy (*Engraulis japonius*), yellow tail (*Seriola quinqueradiata*) and dry-salted mackerel were purchased at different seasons of year, starting July at Seoul Central Fish Market in order to examine the seasonal variations in relative contents

of histamine, total volatile bases (TVB) and trimethylamine (TMA). The species of fish were picked off randomly at the retail lots in the Market among those that are generally known to be of potential histamine related poisoning problems (Takagi *et al.*, 1969), typically fatty and pelagic fish, and that were available in the Market at the time of each purchase. The samples were collected and analyzed in such a way to reflect the conditions that could be found in present distribution systems in Seoul areas (Sasayama and Amano, 1970). At least six fishes from each sample were passed through a food chopper three times and a portion of the finely ground whole fish slurry was used for required chemical analysis. Each value was presented as arithmetic means of four determinations.

At the same time, samples of canned products of horse mackerel, saury, sardine (*Sardinia melanosticta*) and seasoned saury were also collected in a similar manner at supermarket or conventional open market places in Seoul for the analyses of histamine, TVB and TMA contents. Before the analysis, all canned product samples were drained and the liquor free contents only were prepared into the finely ground slurry as above. At least three canned samples

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from each were made of each slurry sample. Again each value was presented as arithmetic means of four determinations.

Analytical methods

For estimating histamine contents, the cation exchange procedure of Kawabata *et al.* (1960) was employed. However, in order to insure a complete separation of histidine from trichloroacetic acid (TCA) extracts of fish samples, the volume of washing acetate buffer (0.2N, pH 4.6) was increased from 90 to 200 ml. Also for a complete elution of histamine from the Amberlite CG-50 column, the volume of 0.2 N HCl eluent was increased from 15 to 32 ml. The above two modifications produced results much more reliable and reproducible as ascertained by a series of test runs with known quantity of histamine. With six operating cation exchange columns, it was possible for one skilled

person to analyze 48 samples a day for histamine content. The columns were repacked every week with either fresh or regenerated resins.

TVB nitrogen was estimated by microdiffusion method of Conway and Byrne (1933) as modified for fish by Beatty and Gibbons (1936), using 10% TCA extracts of each sample. TMA nitrogen was estimated by the same microdiffusion method after fixing ammonia by adding neutralized formalin prior to addition of saturated K₂CO₃ solution. Results were expressed as mg N per 100 g meat.

Results and Discussion

Seasonal variations in histamine, TVB and TMA contents of various fresh fish sampled at Seoul Central Fish Market are presented in Table 1. The fresh fish available at the Market during early morning are generally considered to be at their

Table 1. Survey on fresh fish sampled at Seoul Central Fish Market at different seasons

Name of fish	Analysis	Sampling date					
		7-15	10-3	12-17	2-12	5-27	8-20
Mackerel	Hist	4.5	3.1	1.7	2.0	3.2	1.6
	TVB	19.0	24.5	23.5	19.6	28.7	20.0
	TMA	3.5	4.9	7.0	6.3	9.9	7.5
Spanish mackerel	Hist	2.3	1.1	1.7	1.8	3.3	NA
	TVB	17.5	20.3	22.5	15.5	32.9	NA
	TMA	3.5	4.0	4.1	5.6	7.1	NA
Saury	Hist	2.9	2.7	1.9	1.4	4.9	NA
	TVB	37.1	37.2	16.8	18.3	34.3	NA
	TMA	7.0	8.4	7.1	4.9	9.2	NA
Herring	Hist	2.3	2.1	NA	1.6	6.2	NA
	TVB	18.2	17.5	NA	15.5	33.7	NA
	TMA	4.9	7.1	NA	4.1	7.7	NA
Anchovy	Hist	1.8	2.7	NA	NA	5.2	NA
	TVB	16.5	23.1	NA	NA	39.9	NA
	TMA	5.6	7.1	NA	NA	9.9	NA
Yellow tail	Hist	NA	6.3	1.8	1.7	7.9	1.5
	TVB	NA	33.6	24.1	17.5	29.4	20.0
	TMA	NA	5.7	7.1	4.1	8.5	8.4
Dry-salted mackerel	Hist	6.3	11.2	5.2	1.7	5.3	7.9
	TVB	35.2	25.9	18.3	16.9	39.3	16.8
	TMA	6.3	7.1	4.1	8.5	9.1	7.7

NA: Not available for analysis

Unit: Histamine (Hist); mg/100 g meat; total volatile bases (TVB) and trimethylamine (TMA); mg N/100 g meat

Table 2. Survey on canned fish products sampled at different seasons at retail stores in Seoul areas

Sampling date	Canned product	No. brands analyzed	Histamine		TVB		TMA	
			Individual	Means	Individual	Means	Individual	Means
7-21	Mackerel	6	6.7		52.2		14.3	
			6.9		38.5		10.2	
			8.9		50.1		12.7	
			6.9		48.9		9.8	
			8.4		51.8		8.4	
	7.0	7.9	44.2	47.6	11.3	11.1		
	Saury	3	9.8		44.2		7.6	
			14.4		47.0		8.9	
			12.2	12.2	45.0	45.4	9.3	8.6
10-8	Mackerel	2	23.4		65.8		7.0	
			15.9	19.6	46.9	56.3	9.8	8.4
	Sardine	2	18.2		36.9		7.0	
			12.3	15.2	35.3	36.1	10.6	8.8
	Saury	4	6.2		46.9		7.0	
			14.5		51.2		7.7	
			6.8		37.9		8.4	
			8.6	9.5	43.4	44.8	10.5	8.4
	Seasoned saury	1	4.5		43.4		8.4	
	1-12	Mackerel	4	5.6		42.7		7.7
9.3					43.4		11.9	
6.8					35.3		7.7	
5.7				6.8	38.5	39.9	9.8	9.3
Saury		7	7.9		32.9		9.8	
			4.2		37.1		10.6	
			9.9		29.4		6.4	
			12.1		48.3		7.7	
			12.6		33.7		8.5	
			9.3		32.3		9.2	
Seasoned saury		4	7.5	9.2	34.4	35.4	9.2	7.3
			9.6		41.3		5.7	
			6.5		36.4		9.1	
			6.3		32.9		6.4	
7.2	7.4	32.9	35.8	7.0	7.1			
3-23	Mackerel	4	5.7		42.0		13.5	
			5.9		40.5		7.6	
			8.8		39.1		7.0	
			9.7	7.5	45.2	41.7	10.7	9.7
	Saury	5	11.6		29.5		7.0	
			7.9		35.5		10.5	
			4.1		31.5		10.6	
			7.4		38.5		10.1	
	Seasoned saury	3	4.7	7.1	46.1	36.2	14.1	10.4
			3.8		38.5		11.2	
			10.1		28.7		5.7	
			5.9	5.6	35.0	34.0	11.2	9.4

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(Table 2. continued)

Sampling date	Canned product	No. brands analyzed	Histamine		TVB		TMA	
			Individual	Means	Individual	Means	Individual	Means
7-5	Mackerel	4	5.1		43.4		14.7	
			9.6		44.9		14.1	
			3.6		38.6		11.2	
			8.4	6.7	39.9	41.7	15.3	13.8
	Saury	4	7.2		34.9		11.3	
			8.8		38.5		10.6	
			6.2		36.4		8.4	
			7.2	7.4	36.5	36.6	9.9	10.0
	Seasoned saury	3	10.7		41.4		9.8	
			4.1		34.3		7.9	
			8.1	7.6	44.8	40.2	8.4	8.7
10-28	Mackerel	5	18.4		56.8		8.8	
			20.8		50.3		11.1	
			15.8		40.2		10.2	
			22.2		54.3		7.7	
	Saury	3	14.3	18.3	40.7	48.4	9.7	9.5
			8.5		32.2		7.0	
			12.7		40.3		8.2	
			18.2	13.1	45.2	39.2	9.2	8.2
	Seasoned saury	2	11.3		30.2		7.8	
			19.1	15.2	40.7	35.4	9.7	8.7

Unit: Histamine; *mg/100 g* meat; total volatile bases (TVB) and trimethylamine (TMA); *mg N/100 g* meat

first quality, for fish are being transported to Seoul during night from nation's fish landing ports and they are auctioned before the daybreak to local wholesale dealers including retail outlets in the Market.

Although there were some cases in which fresh fish purchased during the warm months of year were doubtful about freshness, histamine contents of all fresh fish were unalarmingly low. However, it should be pointed out that drawing a meaningful conclusion from the results based on this type of one year survey works would be quite unreasonable.

Data on histamine, TVB and TMA contents of several species of canned fish products sampled at different seasons of year are shown in Table 2. As it was the case with the fresh fish samples, low histamine contents suggested no real cause for concern on potential histamine poisoning related problems from eating these canned fish products. It is interesting to note, however, that, although not directly relatable each other due to lack of past handling history, the histamine and TVB and TMA

values of the canned products were in general rather higher than those of corresponding species of fresh fish. This indicated either that fish used for canning purpose were not always of the first quality or that fish storage conditions prior to canning at cannery should be improved.

As conclusion, survey data based on one year of analysis for histamine, TVB and TMA contents of a limited number of fresh fish species and canned fish products indicated that potential danger of histamine poisoning related problems is non-existent in the products as available through present distribution systems in Seoul areas.

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생선과 생선통조림의 히스타민, 전취발성염기 및 트리메틸아민 함량

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서울 근교의 유통과정에서 생선 및 생선 통조림을 선별하여 히스타민, 총 취발성 염기 및 트리메틸아민의 함량을 계절에 따라 조사하였다. 생선의 경우 히스타민은 육중에 1.7~6.0 mg% 을 함유하였고 계절에 따른 차는 별로 나타나지 않았으나 10월에 구입한 염장 고등어가 11.2 mg% 으로 가장 높았다. 총 취발성 염기는 계절에 관계없이 17~40 mg% 로 비교적 유사한 값을 보였고 트리메틸아민도 3.5~7.0 mg% 으로 시료에 따라 큰 차이가 없었다. 생선 통조림의 경우 10월에 구입한 고등어 통조림에서 히스타민 19.6 mg%, 총 취발성 염기 56.3 mg%, 트리메틸아민 8.4 mg% 로서 다른 제품에 비해 약간 높은 경향을 보였으나 시료와 계절에 따른 큰 차이는 없었다. 결론으로 서울 지방에서 현재 유통되는 생선 및 생선 통조림은 히스타민과 관련되는 독성 문제는 없는 것으로 판단 되었다.