Vet.Med.J.,Giza. Vol.41,No.3.(1993):67-71

HISTAMINE LEVEL IN IMPORTED SCOMBROID FISHES

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Received : 14/12/1993

SUMMARY

A total of 100 imported scombroid fish samples, 50 of each frozen mackerel and canned tuna were used in this study for determination of pH value, histamine content as well as isolation of histamine producing bacteria.

pH. values in imported frozen mackerel ranged from 5.4 to 6.8 with a mean value of 6.1 while they were from 5.6 to 6.8 with a mean value of 6 in canned tuna. Eighty six percent of mackerel samples and 16% of canned tuna ones showed histamine content that exceeded the permissible level (10 mg/100 gm),while 10% of imported frozen mackerel and 2% of canned tuna exceeded 25 mg/100 gm.

None of the examined samples reached the hazard action level of histamine (50 mg/100 gm).

Proteus species, followed by klebsiella pneumoniae and Enterobacter aerogenes could be detected in high frequency as compared with other isolated organisms.

The health hazard effect of histamine and suggestive measures for reducing the risk were discussed.

INTRODUCTION

Histamine associated poisoning was first recognized in 1955 (Schormüller,1966) . Later in the last two decades many authors had reported several outbreaks of histamine poisoning. The most common vehicle foods were mackerel , tuna fish and blue fish (Omura et al. ,1978) (Taylor et al. , 1979) and (CDC,1989) .

Histamine is produced by bacterial decarboxylation of histidine in the food material. The muscles of scombroid fishes relatively contain large quantities of histidine , a character which makes this group of fishes a common vehicle for histamine poisoning Edmunds and Eitenmiller (1975). , Hudson and Brown. (1978). , Arnold and Brown. (1978)., Draughon et al. (1987) and Ababouch et al. (1991). The effect of storage temperature and pH value on histamine production has been also discussed by (Okuzumi et al., 1984, Draughon et al., 1987, El-Marrakchi et al., 1990 and Bannour et al., 1991).

Where food poisoning occurred, values for histamine were above 100 mg/100gm, despite of many countries consider 10 mg/100gm to be the permissible limit accepted for histamine content in fish and fish products.

Food and Drug Administration (FDA, 1982), determined the hazard action level of histamine in tuna fish with 50 mg/100gm.

Estimating the frequency of histamine poisoning is difficult because, most countries do not regulate histamine level in foods, nor they require notification when an incident of histamine poisoning occurs, also because histamine poisoning closely resembles food allergy, it may often be misdiagnosed. The available data on symptoms associated with outbreaks of histamine poisoning and food incriminated in Japan, U.S.A., U.K., France, Denmark, Canada and New Zealand was revealed by Taylor (1985).

This study was carried out to determine histamine quantitatively in imported frozen mackerel and

imported canned tuna with a special reference to histamine producing bacteria found in them.

MATERIAL AND METHODS

Fifty samples of each imported frozen mackerel and imported canned tuna were used in this study. The samples were collected from Giza markets and grocery stores and submitted to the following experimental techniques:-

1- pH value was determined according to the method recommended by Solomon; (1987).

2- Determination of histamine content:

- Extractions was prepared according to method described by Draughon et al. (1987).
- Histamine was detected by thin layer chromatography (T.L.C) according to method described by Egyptian Organization for Standardization (1991).

. Quantitative determination of histamine was done fluorometrically according to the method recommended by AOAC (1980) using standard curve of various concentrations of histamine and a regression equation.

3- Isolation and identification of histamine producing bacteria:-

- Microflora recovered from examined samples on Violet Red Bile Glucose Agar incubated at 35°C for 24 hours were obtained according to Oblinger et al; 1982 and were identified biochemically according to method recommended by Krieg and Holt (1984).
- Isolates suspected to be Pseudomonas were identified biochemically according to Edwards and Kraszewski (1991).

RESULTS AND DISCUSSION

Table (1): pH and Histamine values in frozen mackerel and canned tuna

Samples	No. of Samples	pH value			Histamine content		
		Min	Max	Mean	Min	Max	Mean
Frozen mackerel	50	5.4	6.8	6	7	25	17
canned tuna	50	5.6	6.8	6.1	<5	20	8

With regard to the results recorded in Table (1), it is evident that pH value of imported frozen mackerel samples ranged from 5.4 to 6.8 while canned tuna ranged from 5.6 to 6.8 with mean values of 6 and 6.1 respectively. These values are appropriated from histidine synthesis and optimum for the activity of that enzyme as well as freezing or icing lead to slow rise of pH value in the samples to reach 6.8 but this value did not create the favourable condition for histamine production by bacteria. This simulates the findings reported by Ryder et al. (1984), El Marrakchi et al. (1990) and Bennour et al. (1991). Moreover, Abubo et al. (1991), stated that histamine production was more active by three Proteus species at pH value than 7.

Histamine content in frozen mackerel ranged from 7-25 mg/100gm of fish muscles with mean content 17 mg/100 gm while in canned tuna it ranged from <5-20 mg/100 gm. with mean value 8 mg/100 gm (table 1). None of the examined samples showed histamine content exceeding toxic level recommended by FDA; (1982)(50 mg/100 gm).

Such lower histamine values reported for canned tuna samples in comparison with those reported from frozen mackerel can be attributed to the heat treatment of the products during the canning operation. On the contrary in case of frozen mackerel and during the pre-freezing phase some histamine producing flora had got enough chance to propagate , multiply and produce histamine (Frank et al.,1983).

Table(2): Frequency distribution of histamine content in frozen mackerel and canned tuna.

Frequency	Frozen mackerel		canned tuna	
	No.	%	No.	%
> 5 mg/100gm	50	100	35	70
> 10 mg/100gm	43	86	8	16
> 15 mg/100gm	35	70	4	8
> 20 mg/100gm	17	34	3	6
25 mg/100 gm	5	10	1	2

With regarded to frequency distribution of histamine content in the present data (Table 2), all examined samples of imported frozen mackerel samples and 35 (70%) imported canned tuna

contained histamine > 5-10 mg/100gm. Although that level of histamine is accepted by Egyptian Standard for Frozen Fish, (1991) and for Canned Tuna, (1990), such level of histamine in fish and canned fish is considered unsafe due to time elapse until they reach consumers depending on temperature, ways of keeping and handling and distance. This agrees with the results reported by Hobbs (1981) and Alasalvar et al. (1992). On the contrary., Murray et al. (1982) found that there was no relation between histamine level and fish spoilage, histamine level did not rise much above 5 mg/100gm in mackerel samples unfit to eat (spoil in ice). Morover, Bennour et al. (1991) recorded that production of histamine is not always associated with easily detectable sensory changes in fish and its analysis is not necessarily a good index for deterioration. Eighty six percent and 16% of examined frozen mackerel and canned tuna respectively contained histamine exceeding 10mg/100gm, such level was described as critical level by Billon (1978), Moreover, Lam (1989) reported five outbreaks annually of histamine poisoning in Denmark attributed to consumption of tuna or mackerel containing histamine from 10-20 mg/100gm, therefore such level was used as a guide. The variations in the reported histamine levels enough to induce the scombroid syndrom had been explained by (Hudson and Brown ,1978) , they believe the evidence does not favor histamine persent as the agent responsible for the syndrome. They suggest a synergistic relationship involving histamine and others as yet unidentified agents such as other amines or factors that influence histamine absorption.. Only 5 (10%) and 1 (2%) of imported frozen mackerel and canned tuna contained histamine level 25 mg/100gm. None of the examined samples showed histamine level exceeding 25mg/100gm. High levels of histamine were recorded by Connell (1975) who stated that 30-40 mg/100 gm proposed as a limit of acceptability for fish of cold and temperate waters.

From table (3) it is clear that Enterobacter aerogenes, Enterobacter coloacae , E. coli, Klebsiella pneumoniae, Proteus mirabilis, Proteus morganii, Proteus vulgaris and Providencia sturtii could be isolated from mackerel and canned tuna with various incidences, in addition to Pseudomonas fluorescens and Pseudomonas putida which could by isolated only from frozen mackerel. It could be concluded that high incidence of isolation was recorded in Proteus species followed by klebsiella pneumoniae and Enterobacter aerogenes. This is in agreement with that recorded by Arnold and Brown(1973,) Ryser et al.(1984), Ababouch (1991) and Alasalvar et al. (1992) . Most of histamine producing bacteria are mesophilic and belong mainly to enteric bacteria which are not considered as a part of normal flora of fish but are instead handling contaminants. That was confirmed by Draughon et al., (1987) and Stanescu et al., (1986) who stated that histamine content correlates positively with the total number of mesophilic germs as well as it is difficult to prevent production of histamine toxic level if the microbial load is high. In this respect, Behling and Taylor; 1982 stated that Morganella morganii strains were probably the predominant microflora detected and referred to as histamine-producing bacteria. The presence of such microorganisms in canned tuna despite of exposure to high temperature may be due to recontamination from the environment, after pre-cooking & handling during canning process from handlers and materials as recorded by Lopez-Sabater et al. (1993). On the other hand, Ryser et al. (1984) reported that psychrotrophic bacteria obtained from raw tuna fish were identified as Pseudomonas putida and Pseudomonas fluorescens and non fluorescent pseudomonas species has ability to produce histamine.

Table(3):Incidence of Isolated Bacteria from Mackerel and tuna samples.

	Frozen mackerel		canded tuna	
	No.	%	No.	%
Enterobacter aerogenes	6	12	4	8
" *coloaca*	4	8	2	4
Escherichia coli	5	10	3	6
Klebsiella pneumoniae	4	8	1	2
Proteus mirabilis	7	14	5	10
" *vulgaris*	9	18	4	8
Providencia sturtii	6	12	1	2
Pseudomonas fluorecens	4	8	2	4
" *putida*	3	6	-	-
	2	4	-	-

From the present study and to safequard the health of the Egyptian consumer; it could be suggested that; the imported frozen raw fishes and the

canned ones must be subject to the following before addmittance to the local market;

1. Microbiological monitoring with special stress on the histamine producing group. and in case of heat processed canned fishes; positive batches must be rejected.

2. Application of the quantitative histamine test in connection with the sensory evaluation, because some scombroid fishes may be sound organoleptically, yet contain high histamine .

3. Follow up of importated frozen fishes after addmittance to the country and periodical check on the freezing stores, because 24 hours freezer failer are enough to reach the hazardarious histamine level (Frank et al., 1983).

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