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Short Communication

Comparative study on Histamine Levels in Common Farm Fishes

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ABSTRACT

Histamine fish poisoning (HFP) is caused by consuming a bacterially contaminated fish that are capable of producing histamine. Histamine may cause food intolerance and allergic reaction. The aim of this study is to investigate the occurrence and level of histamine in fish that are commonly consumed in Kafr Elshiekh Governorate. Accurately, 90 samples from three different species of fish represented by *Mugil cephalus* (*M. cephalus*), *Oreochromis niloticus* (*O. niloticus) and Clarias gariepinus* (*C. gariepinus*) (30 of each) were collected at different times from different farms in KafrElshiekh Governorate and examined for determination of their histamine levels "mg%" using Enzyme-Linked Immunosorbent Assay (ELISA). Histamine was detected in all fish samples with mean values as following 9.76 ± 0.12 in *M. cephalus*, 13.32 ± 0.17 in *O. niloticus* and 21.05 ± 0.26 in *C. gariepinus* with acceptability of 82.22 % according to EOS (2005).

1. INTRODUCTION

Fish is highly susceptible to biogenic amine formation, especially histamine, putrescine, cadaverine and tyramine (Bunka et al., 2013).Histamine can be catabolized through two routes in fish muscle: by amino acid deamination forming urocanic acid, which is the main route in normal physiological conditions or by decarboxylation forming histamine, which is an important route in cases of bacterial contamination (Lehane and Olley, 2000).

The content of biogenic amines in fish can vary according to the season of the year, genetics, environment, food, sex, physiological stage, storage period and sampled tissue storage temperature (Carmo *et al*., 2010).

The presence of biogenic amines in food, besides being a health problem due to its physiological and toxic effects (Önal, 2007), can be used as quality index, once they are formed by bacterial activity and are resistant to thermal treatment, thus reflecting the quality of the raw material and the hygienic conditions of food processing (Park *et al*., 2010, Sagratini *et al.*, 2012).

Histamine is produced by bacterial actions, e.g. spoilage and fermentation, in fish species which have a naturally high level of the amino acid histidine. Generally, this takes place at a temperature of more than 25°C over a period of more than 6hours or for longer at lower temperatures (FAO/WHO, 2012).

Histamine Fish Poisoning (HFP) is described as a food borne chemical intoxication primarily caused by intake of fish muscle containing an elevated amount of histamine (Emborg and Dalgaard, 2006).

Intake of high level of histamine leads to life threatening food intoxication, food intolerance and allergic reaction (Berjia and Brimer 2013).

The present study carried out for evaluation of histamine values in three species of fish (*Mugil cephalus, Oreochromis niloticus* and *Clarias gariepinus*) and determination of the degree of acceptability of these species.

Scombrotoxin fish poisoning (SFP) is a worldwide food safety problem and is a common cause of fish poisoning that occurs in humans. The food poisoning is caused by heat-stable scombrotoxins, presumably arising from bacterial action in fish. The incriminated fish usually contain high levels of histamine due to bacterial activity resulting from inappropriate handling, processing or storage conditions, and histamine has been implicated, at least in part, as an important causative agent(Hungerford, 2010).

2. MATERIAL AND METHODS

Ninety random samples of farm fishes represented by *Mugil cephalus*, *O. niloticus*, and *C. gariepinus* (30 0f each) were collected from the different fish farms located in KafrElshiekh Governorate. The weight of samples ranged from 200 g (*M. cephalus* and *O. niloticus*) to 400 g (*C. gariepinus*). Each sample was kept in a separated plastic bag and preserved in an ice box then transferred to the laboratory and examined chemically as quickly as possible to determine their keeping and safety for human consumption. Sample preparation was performed according to the procedures specified in the histamine test kit (available for purchase separately, cat. no. BA E-1100). After sample preparation, acylation and Enzyme-Linked Immunosorbent Assay (ELISA) was conducted using the reagents following the protocol provided together with the kits. The obtained results were statistically evaluated by application of Analysis of Variance (ANOVA) test according to (Feldman *et al.*, 2003).

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3. RESULTS AND DISCUSSION

Histamine is a naturally occurring endogenous substance in the human body which is derived from the decarboxylation of the amino acid histidine. Histamine may also be present in certain foods containing free histidine and is generated by certain bacteria during spoilage and fermentation of fish. Histamine-rich foods may cause food intolerance in sensitive individuals and histamine contamination in fish and fish products.

The results recorded in table (1) show that histamine levels "mg %" in the examined samples of farm fishes varied from 1.86 to 22.93 with an average of 9.76 ± 0.12 in *M. cephalus*, also, from 2.55 to 29.14 with an average of 13.32 ± 0.17 in *O. niloticus* and from 4.73 to 46.29 with an average of 21.05 ± 0.26 in *C. griepinus*.

Table 1 Statistical analytical results of histamine levels "mg %" in the examined samples of farm fishes (n=30).

Fish species	Min	Max	Mean ± S.E
Mugil cephalus	1.86	22.93	9.76 ± 0.12
Oreochromis niloticus	2.55	29.14	13.32 ± 0.17
Clarias griepinus	4.73	46.29	21.05 ± 0.26 ++

The differences between the examined samples were highly significant (P<0.01). q(2005) had laid down the critical limits of histamine for chilled fish portion should not be more than 20mg% so, 82.22% of examined samples as shown in table (2). According to Egyptian Standards (ES) (2005) the critical limits of histamine for chilled fish portion should not be more than 20mg % as in table (2). Therefore, 82.22% of the examined samples were accepted. These results were close to those of (Ibrahim, 2017), while lower than those obtained by (Berjia and Brimer 2013). All foods that are rich in protein are susceptible for histamine formation, if desirable conditions are present for the microorganisms and the enzyme (Lehane and Olley, 2000). Optimal temperature for histamine formation is variable due to different microorganism involved in the formation of histamine in fish (FDA, 2001). The control of histamine is basically targeted on the control of its initial formation, this can be achieved by control of microbial population that can form histamine (Kerr *et al.,* 2002).

Table 2 Acceptability of the examined farm fishes according to their histamine values (n=30)

Fish species	Maximum Permissible Limit (mg/Kg) *	Accepted samples		Unaccepted samples	
		No.	%	No.	%
Mugil cephalus	20	28	93.33	2	6.67
Oreochromis niloticus		25	83.33	5	16.67
Clarias griepinus		21	70	9	30
Total (90)		74	82.22	16	17.78

* Egyptian Organization for Standardization "EOS" (2005).

As conclusion, the purpose of this study is Determining the level of histamine in order to prevent or reduce the formation of histamine on fish and fishery products, the rapid cooling of fish after catching and the maintenance of adequate refrigeration during handling and storage is recommended. Also, the reduction of the uncertainty surrounding the critical role played by histamine in the pathogenesis of SFP is needed. Studies that will clarify the mechanistic role and the quantitative relationship of histamine to the spectrum of adverse effects seen in SFP are deemed to be essential.

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