Influence of *Garcinia cambogia* on Histamine of Tuna Fish (*Thunnus albacores)*

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Abstract

Histamine is associated with scombroid fish poisoning in conjunction with the ingestion of some fish species. The formation of histamine in fish products is due to bacterial decarboxilase action on histidine in tissues. Histamine development has a high influence in temperature abuse. The objective of this study was to determine the effect of gamboge/ Goraka (*Garcinia cambogia*) on reduction of formed histamine in Tuna fish (*Thunnus albacores*). Fresh tuna loins which rejected after detection of high amount of histamine were selected. The study conducted in four steps. First two was designed to test the influence of garcinia at room temperature, third was carried out in 80 °C, fourth has been canned and retorted at 116 °C maximum temperature for 100 minutes. Every step was contained control and four kinds of treatments made with the change of Garcinia concentration only. Each control and treatments were repeated three times. Neogen's Veratox Histamine Test Kitwas used in histamine analysis. Results were analyzed in one way ANOVA. There was a significant difference ($p<0.05$) among treatments of each step. Very slight reduction of histamine was attained in room temperature (27 °C). Vast reduction was seized at 116 °C in canning process. At lower temperatures; below 80 °C affected concentration of Garcinia was high. In fresh tuna processing Garcinia cannot be added in the purpose of reducing formed histamine. In the canning industry Garcinia can be clearly added to reduce formed histamine levels in tuna fish.

Key words: Canning, Garcinia, Histamine, Temperature, Tuna

Introduction

Fish and fishery products represent a very valuable source of protein and essential micronutrients for balanced nutrition and good health. Fisheries supplied the world with about 148 million tonnes of fish in 2010 of which about 128 million tonnes was utilized as food for people. (FAO, 2012)

In many countries the bulk of fish is sold fresh for local consumption. Processing, where this is done, is either to supply distant markets or to produce a range of products with different flavours and textures. Fish is an extremely perishable food. Spoilage begins as soon as the fish dies, and processing should therefore be done quickly to prevent the growth of spoilage bacteria. Fish is a low acid food and is therefore very susceptible to the growth of food poisoning bacteria. (Yoshinaga and Frank, 1982)
Canning is a method of preserving food, and provides a typical shelf life ranging from one to five years. Canned fish are fish which have been processed, sealed in an airtight container and subjected to heat.

Grant *et al.* (2005) have shown that as tunas are often caught far from where they are processed, poor interim conservation can lead to spoilage. Tuna is gutted by hand, and then cleaned and filleted, canned, and sealed then heated (called retort cooking) for 2 to 4 hours. This process kills any bacteria, but retains the histamine that can lead to Scombro toxin fish poisoning (SFP).

SFP is caused by ingestion of certain species of marine fish that contain high levels of histamine and possibly other biogenic amines. Therefore existing standards include maximum levels forhistamine in different fish and fishery products.(Luten *et al.*, 1992).

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In the coastal areas of Sri Lanka, fish is preserved with salt and "Goraka" (*Garcinia cambogia*). Goraka has been using for cooking fish and preserving but the affect is not well known (Amarasinghe and Jayaweera, 1994).

The aim of the study was to see the effect of Goraka on formed histamine in gutted and separated flesh of tuna fish (*Thunnus albacores*) and to determine the influence of temperature and garcinia interaction on formed histamine of tuna fish.

Materials and Methods

Study Area

The study was carried out in Tess Agro PLC, No: 87, New Nuge Road, Kelaniya, Sri Lanka. During period of January 2013 to April 2013. For the current study sample were collected from rejected fresh tuna fish loins at storage. Usual processing line of Tess Pvt.cannery was used in processing canned tuna fish.

Study Design

The study was designed to check the influence of garcinia to reduce the histamine which has been developed as a result of temperature abused in entire handling, distribution, and processing steps of tuna fish. Results obtain in control and four treatments were analyzed using SAS analytical system.

Experiment Design

Whole research was conducted in four major experimental steps. Every step was contained control and four kinds of treatments made with the change of garcinia concentration only. Each control and treatment was embodied with three replicates.

Control (C) Fish 10g dice + Water 90 ml
Treatment 1 (T1) Fish 10g dice + Garcinia 0.5 g + Water 89.5 ml
Treatment 2 (T2) Fish 10g dice + Garcinia 1 g + Water 89 ml
Treatment 3 (T3) Fish 10g dice + Garcinia 1.5 g + Water 88.5 ml
Treatment 4 (T4) Fish 10g dice + Garcinia 2.5 g + Water 88 ml

In each treatment and control same amount of fish weight was used and from treatment one to four different garcinia weights were used in increased order. Water was added in order to keep the same volume.

In step two, garcinia solution was prepared to obtain known concentration and changed the volume added in to treatments instead of using direct weight garcinia amount. And also fish sample was prepared as first blend with water and obtained solution was separated in to control and four treatments.

In step three, the mixed solutions (fish + water + garcinia) were heated up to 80 ^{0}C (boiling temperature of the solution). Kept in that temperature for one minute. Water bath was used. Control and all four treatments were prepared as step two and fallowed the same procedure.

In step four, garcinia concentration was changed by weight. Weighed garcinia and water were first mixed and blended. Then each weighed fish and the relevant garcinia paste were added in to separate cans. Can seaming and retort procedure was carried out.

Results and Discussion

There was a significant difference among at least two means of histamine concentrations ($p < 0.05$) in each step.

Step 1

Treatment one, three and four had shown gradual decrease in histamine concentration. But treatment

two had shown a deviation. Only two of the replicates in control had comparatively higher histamine concentrations. That made the mean of treatment two was the highest. Treatment four was significantly different from control and treatment two. Throughout whole loin the histamine development may not in same levels. Therefore, the deviation of treatment three has occurred.

56.25% of reduction in histamine after using garcinia in room temperature at its highest concentration could be seen in this step. (Dispensing the treatment two) Even after the inclusion of treatment two the percentage reduction of histamine is 58.12%.

Step 2

Individual values of control and four treatments had shown the histamine concentrations were same among the samples prepared for the test. The percentage reduction of histamine concentration comparative to the control to treatment four was 16.21%. Treatment four was significant different from all the other comparisons. Differences of mean values present the influence of garcinia on developed histamine in tuna fish.

In the purpose of speeding up the reaction of garcinia the third step was designed. Because second step only had shown a slight reduction of histamine after the treatments, the determination of temperature effect on reaction was needed to clarify.

Step 3

The highest reduction percentage of histamine concentration was achieved in this step was 28.2%. It is from garcinia concentration of 2.5 g. The percentage reduction achieved from 0.5 g garcinia concentration was 8.55%. Treatment three and four were significantly different from control.

Step 4

Conducting under the 116 °C for 100 minutes 50.94 % reduction of biogenic histamine was achieved in this step at concentration of 0.5 g garcinia. Moreover 93.2 % reduction of histamine was attained in garcinia concentration of 2.5 g.

When heated up to 116 °C in retort procedure after canning with garcinia the reduction of histamine was clearly visible. The heating process can be used to eliminate histamine-producing bacteria and their histidinedecarboxylase enzymes from the product. However, histamine is heat stable. If histamine is produced in fish, cooking will kill bacteria but will not eliminate the histamine.

Table1. Histamine concentrations of each step

	Control	Mean	Treatment 1	Mean	Treatment 2	Mean	Treatment 3	Mean	Treatment 4	Mean
	ppm									
Step 1	72.3		54.1		75.8		52.9		37.4	
At room	75.6	67.27	72.3	58.43	70.2	70.27	62.3	46.97	30.2	29.43
temperature in	53.9		48.9		64.8		25.7		20.7	
diced tuna										
Step 2	87.4		83.4		82.8		80.8		76.3	
At room	88.8	88.60	85.3	84.23	83.4	83.03	80.4	81.03	68.5	74.23
temperature in	89.6		84.0		82.9		81.9		77.9	
minced tuna										
Step 3	103.9		92.0		90.5		84.3		68.9	
At 80 °C	96.3	97.73	90.2	89.37	83.6	86.93	80.7	81.73	62.3	70.17
	93.0		85.9		86.7		80.2		79.3	
Step 4	43.4		32.0		7.0		4.2		3.5	
At 116 °C	60.3	53.40	24.4	26.20	8.6	8.20	4.7	4.46	3.6	3.63
	56.5		22.2		9.0		4.5		3.8	

As histamine-producing bacteria are more heat sensitive than spore-forming bacteria that are targeted in the canning process, commercially sterile canned products will not contain any histamine producing bacteria. Furthermore, all enzymes will be denatured by the canning process, meaning that no further histamine can be produced in the product which can then be stored at ambient temperatures.

Addition of Garcinia to tuna fish at room temperature does not greatly affect on histamine reduction which has already formed in fish, although there is a very slight affect in reduction of biogenic histamine in garcinia at room temperature (27 °C). To give this effect need to add a higher concentration of Garcinia. The concentration requires to degrade the formed histamine was comparatively higher than the concentrations commonly use in traditional fish curry preparation in Sri Lanka.

80 °C temperature is not enough for the reaction to boost. The quality of degradation of biogenic histamine having in garcinia does not effectively active at 80 °C or below. Clearly there is a temperature effect in to the degradation of biogenic histamine by garcinia. Hence it still proves the fact that garcinia has an effect in reducing formed histamine at temperatures of 80 °C or below up to 27 °C.

Histamine in canned tuna can be greatly reduced by Garcinia. At a temperature as high as 116 °C, keeping up for 100 minutes great reduction of histamine can be obtained using Garcinia. Importantly at this high temperature use in canning process high efficient from low concentration of garcinia can be realized.

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