Histamine Content Changes During Processing Of Canned Tuna By Indonesian Canning Factories

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Abstract

An assessment was carried out on histamine content of three canning factories. These factories are located in East Java (A), Bali (B) and North Sulawesi (C). Histamine contents were assessed along various stages of their processing.

Results showed that histamine contents changed during processing of canned tuna in both A and B factories and that they increased significantly especially after steaming. In contrast, decreasing histamine content was noted during processing of canned tuna at factory C. These results seem to stem from the fact that a lot of raw material was processed by factories A and B. Histamine was probably produced during delays along the processing line. This was in contrast to factory C in which a special tuna fish was processed for the study and only a small quantity of fish was going through at the time.

Introduction

Canned tuna production in Indonesia has increased during the last ten years and many factories are trying to increase their production. During the same period many factories have been established at many sites in Indonesia. Various parameters are used for determining the quality of canned tuna; but a specific parameter that reflects the hygienic condition at the canned tuna factory is histamine content. High histamine levels are found usually in spoiled tuna and other scombroid fish that have high levels of histidine in their muscle tissue. Studies by many researchers have showed that histamine formation from histidine is caused by histidine decarboxilase enzyme activity, which is present in many types of organisms especially *Proteus morganii*. The presence of histamine in canned tuna is considered to be an indicator of earlier microbial decomposition and reflects the hygienic level of the handling and processing stages.

In order to determine critical points for histamine formation in canned tuna processing, histamine content was assessed at each stage of processing in three tuna canning factories.

Materials And Methods

Samples Collection (Sampling)

Samples, including tuna flesh and canned products were collected from factory A which represented factories in east Java, factory B representing factories in Bali, and factory C representing two factories in North Sulawesi.

Samples included frozen tuna as raw materials, thawed tuna, steamed tuna and canned tuna (end products). Samples were taken randomly from A and B factories, with three replications.

Triplicate samples at the above stages of processing were collected from factory C.

Note: This paper was presented at the Seminar by Dr Sunarya.

Analysis Method

Histamine analysis was carried out at the National Center for Fishery Quality Control and Processing Technology Development (NCQC), Jakarta. The analysis used the spectrophotometry method of AOAC, 14th edition (1984).

Muscle tissues were weighed accurately at the factory's laboratory, put in sampling bottles which contained methanol, stored in a styrofoam box containing ice and transported to the NCQC, Jakarta. At the NCQC laboratory, samples in methanol medium were homogenized and analysed.

All histamine analyses for canned tuna samples were done in the NCQC laboratory using AOAC procedure.

Results And Discussion

Although muscle-tissue samples were analysed at Jakarta, the date of histamine content was considered to be the date of sampling because samples were stored in methanol. In this condition, micro-organisms were not able to grow and no changes in histamine content of fresh, thawed and steamed tuna took place during transportation to the laboratory (2 - 3 days). Also, the histamine content of canned tuna sample did not change during transportation to Jakarta because the canned products had been sterilized and packed under vacuum condition. The overall results of histamine content changes during processing of canned tuna produced by three factories are shown in Fig.1.

Fig.1 shows that histamine content seems to have increased during processing in A and B factories. Increase of histamine content, for A and B factories started from stage 1 to 2 in which, during thawing, micro-organisms probably started to grow. At the time of our visit to these two factories, large quantities of raw material were being processed. This delayed the processing of some raw material and during this stage, histamine was produced. Between stages 2 and 3, in which the fish was pre-cooked, the histamine content seemed to have increased. In these stages, theoretically, the amount of histamine would not change, but the increase of histamine content was probably due to a decrease in moisture content. During precooking of skipjack tuna at some canning factories, we found weight loss of approximately 20 to 24% by weight as a result of decreasing moisture content. Significant changes of histamine content took place in factories A and B between stages 3 and 4 in which the dark muscles were separated manually.

Because of the abundance of raw material in A and B factories, much time was taken up in processing. Contamination of micro-organisms from workers might occur, causing an increase in histamine content.

In contrast, the histamine content of canned tuna produced by factory C decreased along all stages of processing.

Decreases of histamine content occurred at stages 1 and 2. Raw materials (fresh fish) were gutted and washed. Decreases of histamine content in these stages were probably due to washing. The decreases of histamine content during processing in all stages at factory C, may have been a function of the small quantity of raw material being processed and the consequent lack of any delay. This resulted in almost no histamine changes at all stages, other than stages 1 and 2.

It can be seen from Fig.1, that histamine contents in tuna as raw materials in A and B factories were 0.73 mg % and 0.30 mg % respectively. These were much lower than that in C factory (3.6 mg %). This lower value in factories A and B seems to result from better handling applied on board and during transportation in East Java and Bali than in north Sulawesi, which supplied material to factory C.

On the basis of this assessment, we conclude that the histamine contents of canned tuna produced by these three factories were lower than 20 mg % - permitted level for canned tuna applied in the US market. All values found were also lower than 5 mg % which is the permitted level of histamine applied by buyers in western countries.

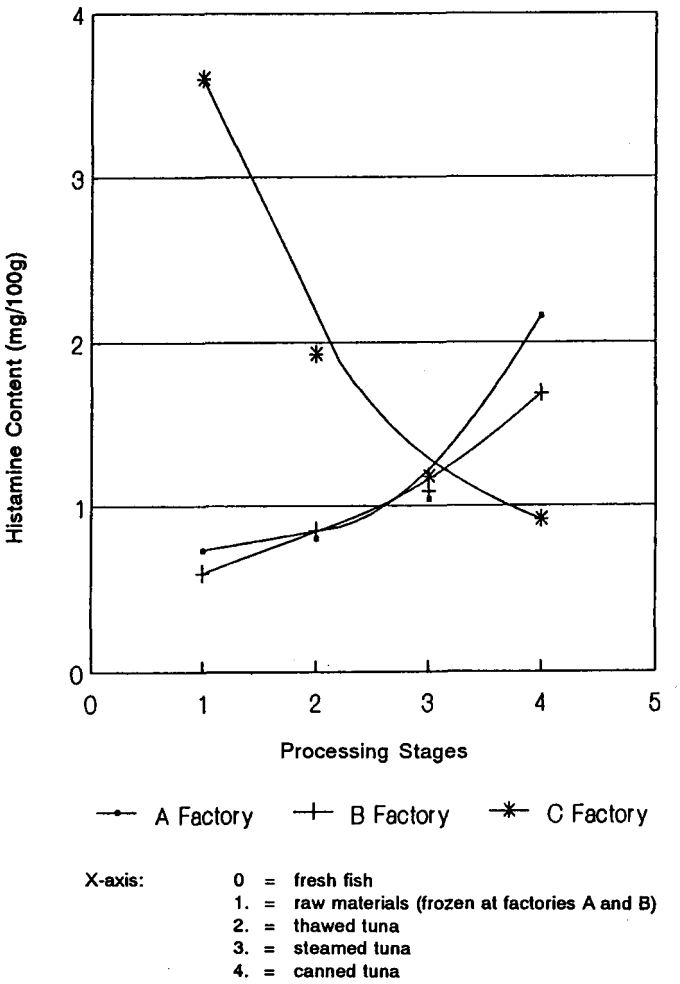

Fig. 1. Histamine content changes during processing of canned tuna.

Conclusions And Recommendation

This assessment concludes that the critical points of histamine formation during the processing of tuna in factories A and B were the thawing and dressing stages. This was due to the large quantity of raw material being processed. The histamine content of the raw material used in factories A, B and C varied, depending on the handling and transportation. However, they were lower than the permitted level mandated in some countries, in particular the USA and other western countries.

In order to maintain the lower histamine content during the processing of tuna in these canning factories, it is recommended that the efficiency of production be increased and that the risk of contamination be held to the lowest possible level.

Future studies, in particular HACCP, can be attempted in other factories, and parameters other than histamine can be used to control the quality of canned tuna.

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Discussion

Asked whether any microbiological work was done in relation to the histamine content in the tuna, Dr Sunarya replied that while no work of this nature was done on the tuna, previous work done on the *peda* (fermented fish) showed that many types of micro-organisms were capable of producing histamine.

Asked whether these micro-organisms were indigenous or due to contamination, Dr Sunarya said that he had no data on the subject.

Asked whether *Achromobacter* spp. were found in the samples, Dr Sunarya reiterated that in this tuna study, no microbiological work was done, but in an earlier study on the *peda*, both *Achromobacter* and *Escherichia* were present.

It was noted that tuna found in the USA had higher baseline value for histamine, and commented that the values reflected in this study indicated good quality. In response, Dr Sunarya said that while the results showed low histamine values, there were data to show that in some localities, the histamine level were very high, and that better control during processing was able to reduce this histamine level.

It was observed that delay during the processing of canned tuna may increase the histamine level and that the most significant effect of this delay would be deterioration of flavour and texture of the final product. As there is a standard for the time delay during processing, it was urged that this be given due consideration.