Occupational histamine poisoning by fish flour: a case report

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Histamine poisoning due to inhalation and skin contact with fish products is rarely described in the literature. This study presents a case of occupational histamine poisoning by spoiled fish flour via inhalation, skin and eye contact. Shipments of fish flour transported in black or blue bags, depending on the source, were handled by 20 harbour workers. Ten workers handling blue bags developed allergy-like skin, eye, gastrointestinal, respiratory and cardiac symptoms within 30 min. Workers handling black bags were symptom-free, except for minimal eye irritation. After consultation with the Poison Control Centre histamine poisoning was suspected. The histamine content, as determined by thin-layer chromatography, was 10-fold higher in samples from the blue than from the black bags (510 mg/100 g flour compared with 50 mg/100 g flour, respectively). Part of the shipment was labelled as hazardous for human health with permission for further usage only under specific personal protective measures. It is suggested that the highest permissible levels of histamine in fish flour and similar products should be set and legally adopted.

Key words: eye symptoms; fish flour; harbour workers; histamine intoxication; Poison Control Center; skin symptoms; thin-layer chromatography.

INTRODUCTION

Histamine poisoning as a result of consumption of spoiled, mainly scombroid fish ('scombrotoxism') is well known and described in the literature. 1,2 The symptoms of histamine poisoning are similar to those present in IgE-mediated food allergy, including nausea, vomiting, diarrhoea, oral burning sensation, itching and rash. The onset of symptoms usually occurs within a few minutes of ingestion of fish and the duration of symptoms can be from a few hours to 24 hours. Histamine, saurine and other toxins responsible for this reaction are formed in food by certain bacteria that are able to decarboxylate the amino acid histidine, although this process can be prevented by proper handling and refrigerated storage. The toxins involved are heat stable and are not destroyed or inactivated by thermal treatment, but are decomposed by exposure to light. 3,4 Normal levels of histamine in fish are <0.1 mg/100 g of fish, spoilage levels are >20 mg/100 g. 5 Fish with histamine concentrations exceeding 50 mg/100 g of fish meat are generally considered to be hazardous, 1,6 and the European Union has set maximum tolerance levels for histamine content in fish meat at 40 mg/100 g. 7 Fish flour is produced from fish meat and residues, or as a by-product of fish-oil production. It is mainly used as a fertilizer and a livestock food additive. So far, no tolerance levels for histamine content have been set.

In this paper, a case report on histamine intoxication of harbour workers who handled bags containing fish flour is presented.

CASE REPORT

Shipments of fish flour from two sources arrived at Rijeka Harbour on a very hot and windy summer day. Fish flour was transported in 'black' or 'blue' plastic bags, depending on the source. The bags were closed, and contaminated with some flour on the outside. Ten harbour workers (mean age 41.7 ± 9.52 years) handled the blue bags, and another ten (mean age 41.9 ± 8.86 years) handled the black bags, without personal protective equipment. The bags were caught by a hook and consequently damaged, with further outside contamination with flour. Within 30 min of starting work, each of the ten workers working with blue bags developed acute,
inflammation. Two workers had only mild skin and eye symptoms which did not require treatment. Eight workers were examined and treated by a physician. A medical history was taken and a physical examination performed. Three of the workers with the most severe symptoms were admitted to hospital. In these three workers skin rash, lacrymation with blurred vision and conjunctival inflammation were accompanied by gastrointestinal (nausea, vomiting, oedema of mouth and tongue), respiratory (cough, dyspnoea) and cardiac (tachycardia, palpitations) symptoms. Routine laboratory findings (blood count, serum electrolytes, renal and liver function tests) were within normal limits. The Poison Control Centre in Zagreb was consulted. Based on the characteristic symptomatology and exposure histamine poisoning was suspected. According to the medical history none of the workers had eaten fish that day or the day before. Treatment with antihistamines was effective, with quick regression of symptoms.

Workers who were at the same time handling black bags with fish flour were symptom free except for minimal eye irritation.

MEASUREMENT OF HISTAMINE CONTENT IN FISH FLOUR

Random samples of the fish flour from the black and blue bags were taken according to Croatian regulations. Samples were taken with a cylindrical metal sampling tube from the bottom, centre and top of the bags. As the weight of the shipment was over 20 tons for both blue and black bags, random samples were taken from every 20th bag and then analysed as average samples within 24 h after the outbreak of symptoms (Croatian Livestock Food Sampling Regulation, 1991).

Histamine levels were determined by thin-layer chromatography (TLC) in the laboratory of the Institute for Public Health of the Primorsko-Goranska County in Rijeka. Methanol extracts of samples were spotted on silica gel plates and after development using a methanol–ammonia system, spots were visualized with a ninhydrin spray. In each sample six replica measurements were obtained and the results showed 510 ± 16.7 mg of histamine per 100 g of flour in the blue bags and 50 ± 3.2 mg of histamine per 100 g of flour in the black bags. The results were confirmed by repeated TLC in the same samples in the laboratory of the National Institute for Public Health in Zagreb as a single measurement (450 mg/100 g in blue and 45 mg/100 g in black bags) (Croatian Livestock Food Analysis Regulation, 1991).

Part of the shipment with high histamine content was labelled as hazardous for human health, with permission for further usage only under specific protective measures.

DISCUSSION

Occupational histamine poisoning due to inhalation and skin contact with fish products is rarely described in the literature. In 1976 a group of authors from Poland reported the occurrence of inflammatory skin symptoms in eight workers employed in fish flour manufacture. The symptoms were described as toxic manifestations in six workers and as allergic reactions in two. Histamine intoxication by inhalation or skin contact can be expected because histamine is a well known biological and pharmacological agent which produces conjunctival, nasal and bronchial inflammation, congestion and muscular spasm. Because of the above mentioned characteristics, histamine is used as a diagnostic agent in nonspecific nasal and bronchial challenges as well as a referent substance for positive skin reactions in routine allergological diagnostic skin tests.

This report presents a case of occupational histamine poisoning by spoiled fish flour via inhalation, skin and eye contact. Histamine poisoning was diagnosed and solved by cooperation of the Poison Control Centre and the local emergency medicine and epidemiological service, confirming the important role of the Poison Control Centre in occupationally related intoxication.

Two groups of workers were concomitantly exposed to different histamine concentrations, resulting in clear differences in toxic manifestations between the groups. Histamine content in the samples from the blue bags was 10-fold higher than values usually associated with clinical symptoms. Also, exposed workers showed a different intensity of symptoms under similar exposure, suggesting interindividual variations in sensitivity to histamine. In pre-employment or periodic examinations of workers with possible occupational exposure to histamine, hyper-reactors can be detected by nonspecific nasal or bronchial challenges and as a preventive measure excluded from exposure.

According to the medical history, most harbour workers experience mild eye and skin irritation almost every time they handle fish flour without personal protective equipment. They are symptom free if protective gloves, face masks and goggles are used. These data indicate that the histamine content in fish flour is usually above tolerance level. In this case, both groups of workers did not use personal protective equipment, particularly face masks, due to weather conditions (temperature of 30°C and a strong wind).

Once released, histamine and other toxins slowly decay, especially if protected from light and provocation of symptoms can be expected with each further handling of spoiled fish flour. Therefore, the part of this shipment with high histamine content was labelled as hazardous for human health, with permission for further usage only under specific personal protective measures. The question remains whether adverse health reactions
can also be expected in animals fed with fish flour containing high concentrations of histamine. It is suggested, therefore, that the highest permissible levels of histamine in fish flour and similar products should be set and legally adopted.

REFERENCES