

Case Study Showing Importance Formalin Detection in Fish

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Abstract

Fish is among the healthiest foods on the planet. In Kerala 80 % of population uses fish as important food. Fish is a highly perishable commodity. In a state like Kerala, where households consume fish on a daily basis, continuous ingestion of formalin might have catastrophic consequences for public health. Fortunately, it is not that hard for consumers to spot contamination in the fish that they have purchased for consumption from markets. Kochi's Central Institute of Fisheries Technology (CIFT) had developed rapid detection kits earlier this year that can detect formaldehyde and ammonia contents in the so-called fresh fish and prevent customers from consuming toxin-laced fish products. In Kerala, 'Operation Sagar Rani' was launched with the very objective of ensuring safety and hygiene at fish handling and distribution centers. In this study different samples of fishes are collected from markets available in Thrissur District of Kerala for detecting formalin. This qualitative study shows that 60% of samples contain formalin

.So there is an urgent need to consumers to check formalin by kits and avoid buying of this contaminated fishes there by preventing this malpractice and support government to ensuring public health.

Key words: Fish, Formalin, Kerala

Introduction

Fish is a highly perishable food item and its quality deteriorates quickly. Hence, maintenance of the freshness and prime quality of fish remains one of the challenging tasks for fish producers, retailers, transporters, traders and processors worldwide. Formalin may be added to fresh fish to enhance its shelf-life considerably compared to existing short-term preservation methods such as icing and refrigeration. Formaldehyde, easily available and cheap, has antimicrobial properties and can extend the shelf life of fish and keep fish appearing fresh for longer time. Formaldehyde is a metabolic product that forms in all cells during the metabolism of amino acids such as serine, glycine, methionine and choline. However, formaldehyde is a highly toxic substance, with

human carcinogenicity. Chronic inhalation can result in respiratory symptoms and irritation of eyes, nose and throat (Zhang et al. 2009a). Increased exposure of this chemical can increase the risk of cancers of the pharynx, nasopharynx and brain, as well as dermatitis and allergic reactions. In a study of industrial workers in the USA exposed to formaldehyde, a statistically significant excess of deaths from nasopharyngeal cancer was observed in comparison with the US national population, with statistically significant exposure-response relationships for peak exposure and cumulative exposure (Hauptmann et al. 2004). Recently, an International Agency for Research on Cancer has classified formaldehyde as a Group 1 carcinogen for humans (IARC 2012). The US Environmental Protection Agency (EPA) proposed maximum daily dose reference (RfD) level of formaldehyde of 0.2 $\mu\text{g/g}$ body weight (Wang et al. 2007). The Italian Ministry of Health proposed maximum formaldehyde level in the cod family of 60 $\mu\text{g/g}$ and in crustaceans of 10 $\mu\text{g/g}$ (Bianchi et al. 2007)

Objectives of study

Qualitative detection of formalin in randomly selected fishes from Trisuur district in Kerala using rapid detection kits.

Relevance of the study

In Kerala the State's food safety department conducted inspections across the State's 14 districts and seized thousands of tons of fish kept in formalin. For instance, officials seized 6,000 kg fish contaminated with formalin in north Kerala's Vadakara. Just that month, 21,600 kg toxic-fish was seized as part of the State's 'Operation Sagar Rani', triggering a debate around the need to further efforts to contain entry and sale of fish preserved in dangerous chemicals. Francis Joy (name changed), a retail fish vendor in one of the busiest markets in Kochi, however, says Kerala's efforts to curb the use of chemicals to preserve fish have yielded only partial success. Formalin is

used to preserve fish when production falls short on account of the ban on trawling operations. Those who mix chemicals with fresh fish cite economic reasons for their actions. Such chemicals are used because the cost of ice for preserving fish is on the rise.

Economics of formalin use

A fishing boat that spends nearly 20 days in the sea requires around 10 tons of ice to conserve the catch till the boat reaches the shore. But to reduce the spend on ice which costs around ₹90 for a block, many boat operators prefer to keep chemicals such as formalin, ammonia etc. before venturing out into the sea. Such catches go unnoticed even when these trawlers reach landing centers. Formalin is used as a sterilizer, as an embalm fluid and preservative in medical laboratories. It is well known for using in the preservation of tissues. Fish traders while transporting fishes to domestic marketing chain sometimes add or spray formalin to prevent spoilage and increase the shelf life. Charles George, president of Swathantra Matsya Thozhilali Union, affiliated to TUCI, says there are allegations that tuna long liners that spend over 20-25 days in the deep sea are using chemicals for preserving the catch. Around 600 fishing trawlers are venturing into the sea from fishing harbours in Kochi and it is a challenging task to inspect all the boats. In Kerala, fish production generally falls short of demand between November to May. At times, nearly a third of the demand is locally available and the rest is imported, say fish vendors. Kerala is a fish consuming State and there is no need to preserve the fish for a long time in view of the surging demand. The State's fish consumption is estimated at 9 lakh tonnes a year against a production of 5 lakh tonnes. Of this, inland water catch constitutes another 1 lakh tonnes. The remaining 3 lakh tonnes have to be sourced from other states. The natural occurrence of formalin or the permissible limit of formalin after the death of a fish (postmortem changes) will not be higher than 4 ppm (parts per million). If the fish with

more than 4 ppm of formalin is traced, it can be concluded that traders have added some chemicals for preservation. The kits developed by CIFT will detect fish with the chemical above 4 ppm. Formaldehyde is toxic, allergenic and carcinogenic and causes inflammation of the linings of the mouth, throat and gastrointestinal tract. The consumption of formalin could also cause muscle problems in humans. in this context

increasing the awareness about formalin containing fishes are necessary.

Materials and methods

The study duration is 3months.125 samples are collected randomly from 5 markets during the study period.The collected samples are represented in table1

Table 1 showing collected fish samples from study area.

MARKET	FISH	QUANTITY
MARKET 1	Seer fish(<i>Scomberomorus commerson</i>)	5
	Tuna (<i>Katsuwonus pelamis</i>)	5
	Rohu (<i>Labeo rohita</i>)	5
	Makeral (<i>Scomber scombrus</i>)	5
	Sardine (<i>Sardina pilchardus</i>)	5
MARKET 2	Seer fish(<i>Scomberomorus commerson</i>)	5
	Tuna (<i>Katsuwonus pelamis</i>)	5
	Rohu (<i>Labeo rohita</i>)	5
	Makeral (<i>Scomber scombrus</i>)	5
	Sardine (<i>Sardina pilchardus</i>)	5
MARKET 3	Seer fish(<i>Scomberomorus commerson</i>)	5
	Tuna (<i>Katsuwonus pelamis</i>)	5
	Rohu (<i>Labeo rohita</i>)	5
	Makeral (<i>Scomber scombrus</i>)	5
	Sardine (<i>Sardina pilchardus</i>)	5
MARKET 4	Seer fish(<i>Scomberomorus commerson</i>)	5
	Tuna (<i>Katsuwonus pelamis</i>)	5
	Rohu (<i>Labeo rohita</i>)	5
	Makeral (<i>Scomber scombrus</i>)	5
	Sardine (<i>Sardina pilchardus</i>)	5
MARKET 5	Seer fish(<i>Scomberomorus commerson</i>)	5
	Tuna (<i>Katsuwonus pelamis</i>)	5
	Rohu (<i>Labeo rohita</i>)	5
	Makeral (<i>Scomber scombrus</i>)	5
	Sardine (<i>Sardina pilchardus</i>)	5
TOTAL		125

CIFTTest Kit which consists of a paper strip and a reagent that helps the user detect if the fish has been smeared by formaldehyde or ammonia. If formaldehyde is detected, the white paper strip will change to blue in 30 seconds and depending on the content of ammonia, it will change to green or blue in two minutes. Currently, each test would cost Rs. 2 and the kit containing 25 strips and reagent would cost Rs.50. These detection methods are simple, rapid and based on visual observation of color development within a span of 2-3 minutes. This kit includes 25 testing strips along with a reagent solution and a standard colour chart to assess the extent of contamination by either formalin or ammonia. The strip has to be scraped on the surface of fresh fish or fish meat, and then 1-2 drops of the reagent solution can be added to see any colour change occurs which can be compared with the attached colour chart for easy detection of adulterants in domestically marketed fish. In case of formalin, if the colour that appears on the strip is light pink, then the sample is free from formalin. If the strip turns green on adding reagent and develops further to become deep blue, then in that case the level of formalin will be between 20-100 mg per kg, which indicates the fish is not safe for consumption.

Fig.1 showing test kit sample



Results and Discussion

From this study 125 samples of 5 fishes namely Seer fish(*Scomberomorus commerson*), Tuna (*Katsuwonus pelamis*), Rohu (*Labeo rohita*), Makeral (*Scomber scombrus*), Sardine (*Sardina pilchardus*) are collected. presence of formalin is detected in 80 samples. The results are represented in fig 2 and fig 3

Fig 2 bar diagram shows the presence of formalin in each group of fishes.

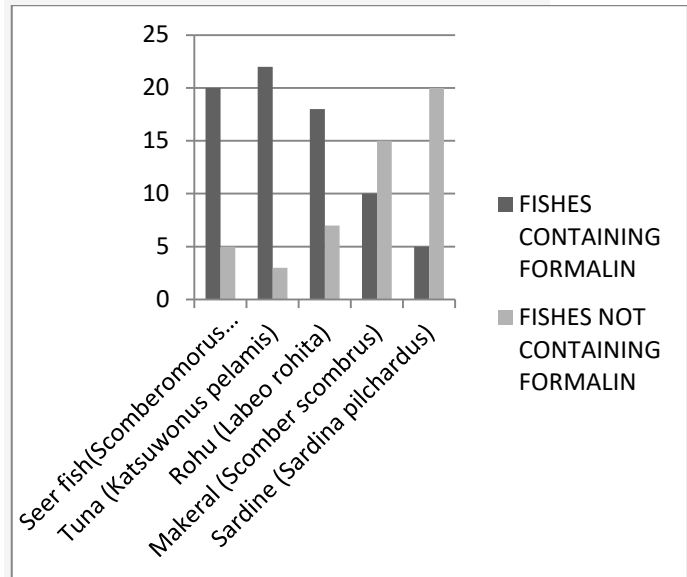
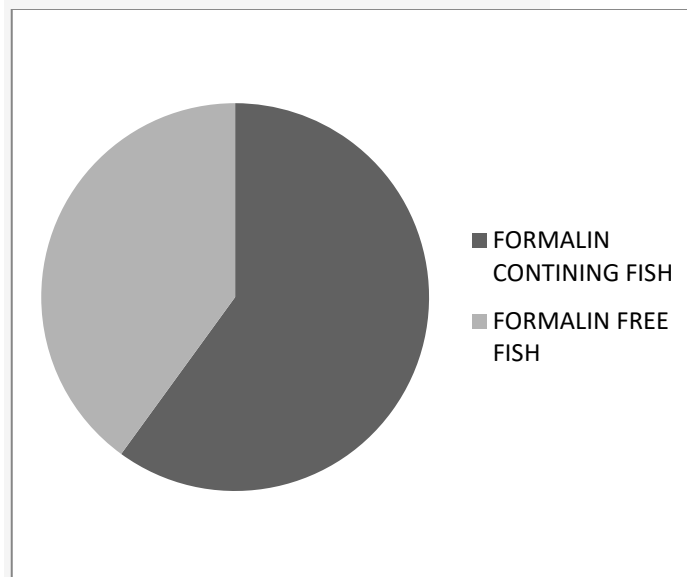


Fig 3 Pie diagram shows percentage of formalin contamination in fishes.



Formaldehyde content was high in high value fishes like seer fish, tuna, rohu, whereas small quantities were observed in makeral and sardine. From collected samples 60% of fishes are shows positive result with formalin. In 2011, the National Toxicology Program, an

interagency program of the Department of Health and Human Services, named formaldehyde as a known human carcinogen in its 12th Report on Carcinogens (National Toxicology Program, 2011). Though it is harmful and potential source of health hazard to human some fish traders are engaged in treating fish with formalin. Checking fish gills, the old method to find out how fresh the fish is, still holds good, in whole fish, the gills are bright red or pink. Gills should not be dry or slimy. They could be slightly wet. Experts tell in fresh fish, the eyes are shiny, clear and bulging. Sunken or wrinkled eyes means the fish is old. The body should be firm and the skin, glowing. Scales should be tightly attached. Loose scales, which tend to slough off, indicate staleness. Fresh fish give off only mild fishy smell. Fish with a pungent smell, which is due to the release of a compound in stale fish called trimethylamine, should be avoided. Consumers need to look for abnormalities in colour, texture, and surface sliminess. In most cases, dishonest traders use formaldehyde to prevent spoilage and keep fish marketable condition. Unavailability of good quality ice at harvest centers, inadequate insulation during domestic transport and lack of warehousing facility for bulk storage of fish are some of the compelling reasons for rampant use of formaldehyde in domestic fish marketing. The added formaldehyde content in fish will decrease during storage due to loss along with ice-melt water, but cannot be fully removed.

Advice to consumers

- Wash all food thoroughly with running tap water, as formaldehyde is soluble in water

and washing can aid the removal of formaldehyde, to a larger extent.

- Wash your fish thoroughly before cooking and discard the water.
- Cook your fish thoroughly to an internal temperature of 75°C or above, as heat from cooking can also aid the removal of formaldehyde, because it is a volatile. Also, check the flesh to see whether it has turned opaque and can be separated easily.
- After repeated washing also, if there is any kind of obnoxious smell or texture, report to concerned food safety authorities.
- Consumers can check the fish for adulteration using rapid detection kit "CIF Test" developed by ICAR-CIFT. The method is simple, rapid, and consumer friendly, detects only the added formaldehyde present in the fish.

Advice to traders

- Do not add formaldehyde to food in general, and fish in particular
- If formalin is added intentionally or unintentionally due to lack of awareness, it is illegal and punishable.
- Ensure that cold chain or proper icing is practiced while transporting fish and shellfish through longer distances.
- Ensure integrity of product throughout the supply chain
- It is a good practice if the fish is screened for formaldehyde content during procurement

Conclusion

Majority of the consumers buy all types of fishes from open market place on 2days/weekly without checking out the presence of formalin before buying fishes. Observing presence of fly on displayed fish sample as well as freshness of eye and overall body are the major techniques to

ensure about formalin treated fishes. Awareness should be built on the hazardous effect of formalin treated fish consumption by the concerned GO and NGOs as majority of the consumers didn't checkout formalin before buying wet fishes. As it is a carcinogenic chemical and has got the ability to produce serious health hazards like cancers of the lung, eye irritation, bronchitis and cough to the population, the government and other agencies need to take necessary steps to prevent such type of malevolent activates by the fish traders to safe guard public health. Stringent policies for formalin mixing in fish should be in place so that consumer safety is considered. There is an urgent need for harsh punishment for formalin adulteration should be implemented by national and international regulators. It is important to Awareness among the consumers should be disseminated widely by modern communication media at national and international levels.

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