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Formalin Treated Fish Marketing and Its Impact on Public Health

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Abstract
Formalin practice has been going on unabated in fish markets of Bangladesh due to some unscrupulous trader's ill intentions and also indulgence by government negligence to check the trends. In order to afford suitable measures to moderate the situation, present study was carried out to investigate the status of formalin laced fish marketing and their impact on human health. The study was conducted in six fish market areas of Dhaka city from June to September 2014. A laboratory test of collected 180 samples of five fish species with formalin detection kit developed by the BCSIR was done to measure whether the fish species are formalin treated or not. Apart from that 120 randomly sampled fish consumers were surveyed in a face to face contact using pre-tested interview schedule. Findings revealed that 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. Consumers are not so concerned about checking out the presence of formalin. However, they observed absence of fly on displayed fish sample as well as freshness of eye and overall body appearance to avoid buying formalin treated fishes. Among the tested 180 fish samples, 11.66% were found formalin treated; of which 25% Rui (tested 36, formalin presence-9) were found contaminated with formalin. Among all formalin treated fishes the rate was found highest in Mirpur-1 bazaar (16.66%) and lowest in Taltola bazar (6.66%). Cough, bronchitis and headache were major perceived health hazards being suffered by the consumers. Consumers should be more conscious about buying Rui (*Labeo rohita*) fish as it is highly subjected to treatment with formalin.

Keywords: Fish Marketing, Formalin, Public Concern, Human Health.

1. Introduction

Food is a significant reason for the considerable number of diseases in the entire world. Bangladesh, a third world developing country of South Asia, is not an exception in this case. Consumption of unsafe food is a serious threat to public health in Bangladesh for last couple of decades. In Bangladesh, most of the food stuffs, be it manufactured or processed, are unsafe for consumption or adulterated in varying degrees. This problem persists at every level of food from preparation to consumption (Ali, 2013) [1]. In Bangladesh, 75% of daily protein consumption comes from fish. Unfortunately, fish is no longer a favorite option for many city dwellers on their everyday menu, and also this as the sale of formalin-laced fish is considering the ultimate substance with a great preservative effect being able to kill microbes or germs without minimal cost, has become a rampant practice in the city's kitchen markets (Daily star, 2009) [14]. Fish is a highly perishable food item; hence quality of fish quickly deteriorated and the process is accelerated with increasing temperature owing to a number of factors such as microbial activity, oxidative reaction and self-enzymatic activity. Therefore, to maintain quality fish needs proper care form the time it is caught until it is served or processed. Fish quality is a complex concept involving with some factors, freshness being one of the most important. Fresh fish means having its original quality unimpaired i.e not deteriorated in any way. Depending upon the marketing and distribution channels, it takes several hours to several days to consume after catching or collecting from rivers or ponds. Therefore, it is highly essential to take proper step to preserve and maintain its quality until reach to the consumer (Paul *et al*., 2014) [10]. Icing is the most common practice of fish preservation in our country. Agents or wholesaler are not using adequate quantity of ice for short term preservation of large quantities of fish to more distant places, which leads to shortened shelf life of fish. Quality loss also occurs due to rough handing when the fishes are transported to market in iced condition by means of trucks, carrier launches and rail ways for short and long distance transport (Reza *et al*, 2009) [12]. As a result, fish lose its quality about 25% to 28% until it reaches to the consumer. Among the total fish production, one forth become inedible in every year accounting uncountable losses to the traders and producers (DOF, 2011) [2].Therefore, some bad traders are trying to apply harmful chemicals like formalin for fish preservation to make them stiff and appear fresher for long periods of time and to prevent decomposition. Formalin, is an inexpensive and effective preservative that is widely used as a disinfectant in many human medicines and cosmetics and as an antiseptic in veterinary drugs and biological and in fungicides, textiles and embalming fluids (Feick *et al*., 2006) [4]. Consumption of formalin preserved fish may cause uncontrolled cell growth or cancer in any part of body like stomach, lung and respiratory system (Ross *et al*., 2002) [13]. Besides, inhalation of formaldehyde causes respiratory system cancer (Marsh *et al*., 2007) [8]. In Bangladesh for the first time this formalin treated was traced form the traders in 2006 during an operation against impure food of a mobile court led by metropolitan Magistrate Rokon –Ud-Doula (Kausar, 2007) [7]. Governments' inadequate monitoring in markets frustrates most citizens. Some customers and small fish traders lament that the government's monitoring issue is confined only to the busy fish markets and not during other times and areas, especially during different stages of fish trading (Goon *et al*., 2014) [5]. There is dearth of information regarding consumers' perception regarding effects of formalin treated

fish on human health hazards. Considering the above mentions fact in view, present study was conducted with the following objectives:

1. To explore the status of formalin-laced fish marketing in selected fish markets of Dhaka city areas.
2. To measure the consumers' perception on impact of formalin treated fish consumption on their health; and
3. To detect the presence of formalin in collected fish samples.

2. Methodology

2.1. Survey on Consumers Concern about Formalin in Fishes

2.1.1 Population and Sampling Technique

The study was conducted in selected fish market (Six fish markets namely Kowran bazaar, Mirpur-1 bazaar, Taltola bazaar, Mohammadpur krishi market, Jatrabari and Shamoli bazaar) of Dhaka metropolitan areas. All the consumers of the selected fish markets were the population of the study. A total of 120 fish consumers were selected as sampled respondents taking 15 from each market areas following disproportionate random sampling technique.

2.1.2 The Research Instrument

In order to collect valid and reliable information from the farmers an interview schedule was developed considering the objectives of the study. Because little was known about the consumers perception on formalin use in fishes in the study area, exploratory information was collected, through group discussions and informal interviews with key informants, using a semi-structured questionnaire. The key informants included government officials, senior citizens, teachers, college students, local leaders and fish traders. With the feedback of the exploratory information, a detailed structured questionnaire was developed. The questions and statements contained in the schedule were simple, direct and easily understandable by the farmers without giving rise to doubt and misunderstanding in their mind. The schedule contained both open and closed form questions. The interview schedule was also pre-tested with 18 consumers from six market areas. Corrections, addition, alternations, rearrangements and adjustments were made in the schedule based on pre-test experience.

2.1.3 Collection of Data

Data were collected by means of face to face interview with respondents by the researcher himself. But to familiarize researcher with study area and for getting local support and establishing rapport during conducting the interview with the respondents, the researcher had to seek help from local leader of the study area. The researcher took utmost care to establish rapport with the respondents, so that they did not feel hesitant or hostile to furnish proper responses to the questions of the interview schedule. Before going to the farmers for interview, they were informed verbally to ensure their availability at the proper places as per scheduled dates and time. The questions were explained and clarified whenever any respondent feel difficulty in understanding them properly. Data collection was started on 01 June 2014 and ended on 15th September 2014.

2.1.4 Measurement of Impact of Formalin on Health Hazards

Information on consumers concern about marketing and use of chemicals in fish and their impact on human health was collected using prescribed questionnaire through direct interview. Health impacts of formalin were measured by using 'four point' continuum viz. 'never', 'moderate', 'high' and 'severe'. A corresponding score of '0', '1', '2' and '3' were assigned against each statements of health impact respectively. Information also collected during data collection were: frequency of fish buying, types of fish buying, awareness on formalin use in fishes, symptoms formalin treated fishes and affected family members.

2.2 Detection of Formalin in Fish Sample

2.2.1. Fish Sample Collection

There are many fish markets are available in Dhaka city. Six fish markets namely Kowran bazaar, Mirpur-1 bazaar, Taltola bazaar, Mohammadpur krishi market, Jatrabari bazaar and Shamoli bazaar were randomly selected for the fish sample collection. From each bazaar, at least six samples of each type of fish are collected. As a result, thirty fish samples were collected for each type of fish from six markets. A total of five types of fishes and 180 fishes sample were collected. Some ice freezing fishes and both local and imported fishes were collected on the basis of their availability. The bazaar and fish samples were collected randomly. On the basis of the organoleptic characteris- tics such as color, odour of neck where broken, odour of gills, general appearance eye, slime and the consistency of the flesh were recognized between locally produced and imported ones of fishes. The fishes were immediately transported to the laboratory and subsequently tested for the formalin detection. Various fish sample e.g. mrigal (*Cirrhinus cirrhosus*), rui (*Labeo rohita*), katol (*Catla catla*), Ilish (*Tenualosailisha*) and sorputi (*Puntius sarana*) were collected from selected wet markets.

2.2.2. Qualitative Detection of the Formalin

At first, the samples were washed with small quantity of water. Three drops washed-out water was taken in a test-tube using a dropper. Formalin detection kit in food developed by Bangladesh Council of Scientific and Industrial Research (BCSIR) was used in this experiment. The kit contains three solutions (No. 1-3). Added 15 drops from solution No. 1 in the test tube containing washed out water. After well stirring, the solution was allowed to wait for 30 seconds. Then 15 drops from solution No. 2 were added in the same test-tube containing solution. After well stirring, the solution was also allowed to wait for 30 seconds. After then 15 drops from solution No. 3 were added in the same test tube containing solution. After adding No. 3 solution, if the color of the solution changes into pink or red color, the presence of formalin was ensured. On the other hand, if the color of the solution remains unchanged, there is no formalin in the sample.

2.3 Data Processing and Statistical Analysis

After collection of data, all the information contained in the interview schedule was edited. All the collected data were then checked and cross checked, compiled, coded and entered into the computer for analysis and interpretation using SPSS program. The SPSS program was quite good and useful for recording, categorizing, tabulation and computing various statistics. Qualitative data were converted into quantitative form by means of suitable scoring. All personal traits were categorized and arranged in simple tables for description. Excel, statistical software was also used for graphical presentation of data.

3. Results and Discussion

3.1 Status of Formalin-Laced Fish Marketing

Information on frequency of fish buying, types of fish buying, confirmation of formalin before buying fishes, indicators of formalin presence in fishes and effect of formalin on human health has been presented under sub section.

3.1.1 Location of fish buying

Data contained in Figure 1 revealed that majority (66%) of the consumers brought fishes from open market whereas 26 percent chain shop and 8 percent from home service delivery system.

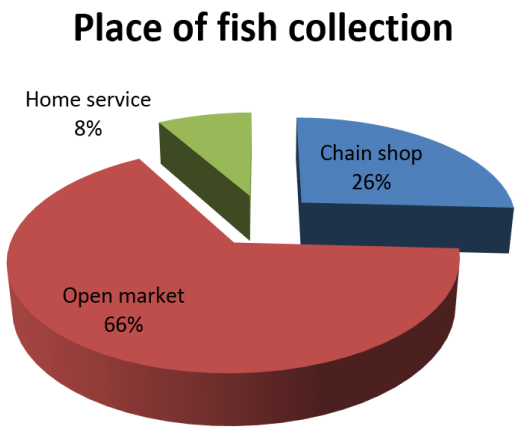

Fig 1: Distribution of the consumers according to their place of buying fishes

3.1.2 Frequency of fish buying

Figure 2 revealed that majority (58 %) of the respondents goes to the fish market on a 2day/week basis whereas 28 percent 1day/week and 14 percent go to the market daily. Distribution of the consumers according to their frequency of fish buying

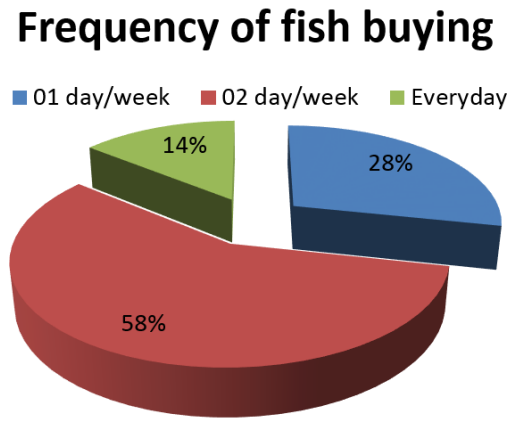

Fig 2: Distribution of the consumers according to their type of fish buying.

3.1.3 Types of fish

Figure 3 revealed that majority (55%) of the respondents purchased all types of fishes followed by 19 percent purchased small size, 18 percent purchased big and indigenous fishes and only 8 percent respondents purchased big and imported fish. It reveals that respondents have diverse fish feeding habit preferably on indigenous fishes.

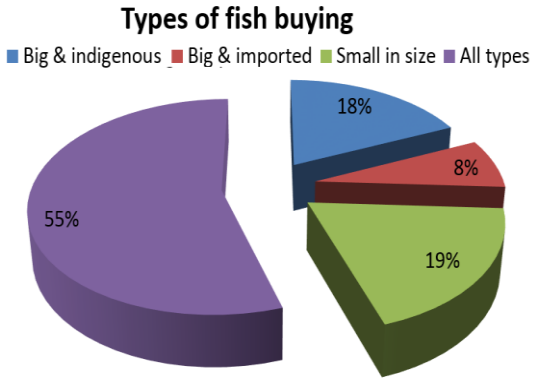

Fig 3: Distribution of the respondents according to type's fish purchased.

3.1.4 Formalin checking behavior

Although newspapers and other media raise their voice against formalin, consumers sometimes didn't take it seriously due to their unconsciousness and lack of knowledge. Figure 4 shows that about 73 percent of the consumers did not check out mixing of formalin before buying fish from the market whereas only 27 percent check out formalin mixing before purchasing fish from the market. It is a matter of great concern that there is a huge scope to raise awareness on formalin mixing in fish and other food items.

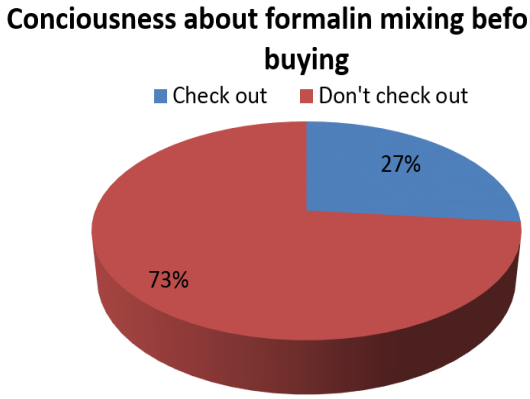

Fig 4: Distribution of the consumers according to their status of checking out formalin mixing before fish buying

3.1.5 Indicators of formalin availability on displayed fishes

Consumers have their own perception and strategy to assess whether the displayed fish is formalin treated or not. But there perception varies from individual to individual. Figure 5 shows the perception of consumers on indicators of formalin presence in displayed fish. It revealed that majority (72.5%) percent of the consumers observe the absence of fly to ensure formalin treated fishes followed by 65 percent look freshness of eye, 52.5 percent looks overall body freshness and 35 percent rely on the promise of retailer.

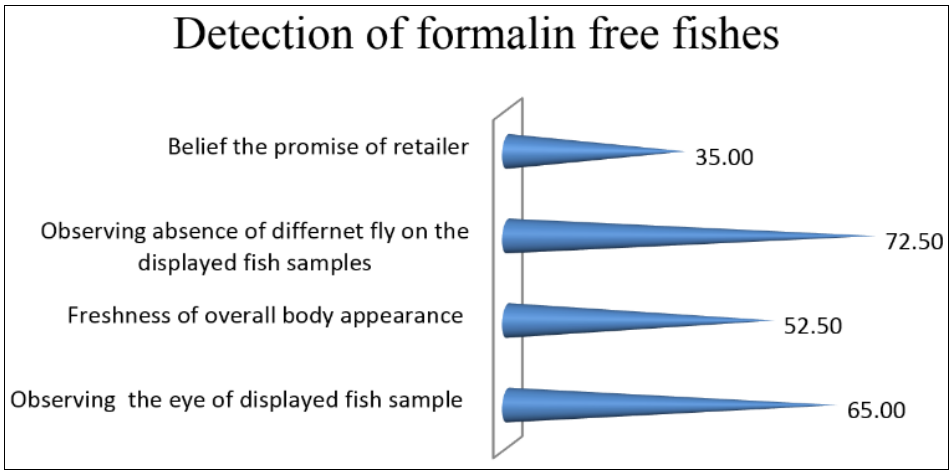

Fig 5: Distribution of the respondents according their perception on indicators of formalin treated fish sample.

3.1.6. Effect of formalin treated fish on human health

In Bangladesh, a certain amount of food stuffs as manufactured or processed, are unsafe for consumption or adulterated in varying degrees. This problem persists at every level of food from preparation to consumption. Food manufacturers, processors, restaurants, fast food outlets and so forth are all involved in one way or another in this corrupt practice of adulteration. Foods are adulterated by using various harmful chemicals and toxic artificial colours on the one hand; and rotten perishables turning to be poisonous foods are stored, sold and served to consumers in an unhygienic atmosphere on the other. This unsafety of food is contributing to the public health seriously with numerous chronic and non-chronic diseases. Consumers' perception on hazardous effects of formalin laced fish consumption has been presented in Table 6. Information in Table 1 shows that highest index (149) of disease severity was found in case of 'cough' which was ranked first. Bronchitis and headache were two other diseases ranked 2nd and third respectively. Vomiting, asthma, skin disease and eye irritation were other diseases respondents are being suffered due to eating formalin treated fish.

Table 1: Distribution of the respondents according to severity of health hazards being experienced

Symptoms	Opinion of the respondents (%)				Index	Rank
	Never	Moderate	High	Severe		
Cough	6.67	44.44	25.56	23.33	149	1st
Bronchitis	14.44	30.00	32.22	23.33	148	2nd
Headache	14.44	41.11	28.89	15.56	131	3rd
Vomiting	14.44	45.56	21.11	18.89	130	4th
Asthma	28.89	37.78	15.56	17.78	110	5th
Skin disease	34.44	37.78	18.89	8.89	92	6th
Feeling discomfort	45.56	21.11	18.89	14.44	92	7th
Eye irritation	35.56	41.11	14.44	8.89	87	8th
Respiratory problem	47.78	32.22	12.22	7.78	72	9th
Nose irritation	52.22	25.56	13.33	8.89	71	10th
Cancer	60.00	27.78	7.78	4.44	51	11th

Never = 0, Moderate = 1, High = 2, Severe = 3

3.2. Laboratory test to detect formalin in fish sample

Studies were conducted on the detection of the formalin in fish obtained from different wet markets in the six areas of Dhaka metropolitan area and the results are presented in the Tables 2. It was found that in many 180 fish sample, 21 fishes were contaminated with formalin in which 13.33% in Kawranbazar (sample—30, formalin contaminated—4), 16.66% in Mirpur-1 bazar (sample—30, formalin contaminated—5), 6.66% in Taltola bazar (sample—30, formalin contaminated—2), 10.00% in Mohammadpur Krishi market (sample—30, formalin contaminated—3), 10.00% in Jatrabari bazar (sample—30, formalin contaminated—3), and 13.33% in Shamoli bazar (sample—30, formalin contaminated—4).

Table 2: Formalin detection in fish sample

Name of the bazaar/market	Name of the fish	No. of fish	Formalin presence	Percentage (%)
Kowran bazaar	Rui	6	Yes (02)	13.33
	Catla	6	Yes (01)	
	Ilish	6	No	
	Mrigel	6	Yes (01)	
	Sarputy	6	No	
Mirpur-1 bazaar	Rui	6	Yes (02)	16.66
	Catla	6	Yes (01)	
	Ilish	6	No	
	Mrigel	6	Yes (01)	
	Sarputy	6	Yes (01)	
Taltola bazaar	Rui	6	Yes (01)	6.66
	Catla	6	Yes (01)	
	Ilish	6	No	
	Mrigel	6	No	
	Sarputy	6	No	
Mohammadpur Krishi market	Rui	6	Yes (01)	10.0
	Catla	6	Yes (01)	
	Ilish	6	No	
	Mrigel	6	Yes (01)	
	Sarputy	6	No	
Jatrabari bazaar	Rui	6	Yes (01)	10.0
	Catla	6	No	
	Ilish	6	No	
	Mrigel	6	Yes (01)	
	Sarputy	6	Yes (01)	
Shamoli bazaar	Rui	6	Yes (02)	13.33
	Catla	6	Yes (01)	
	Ilish	6	No	
	Mrigel	6	Yes (01)	
	Sarputy	6	No	

It is a matter of great concern that, all the (100%) contaminated sample were imported fishes. It also revealed that Rui fish was highly affected by formalin, whereas Mommadpur krishi market represented highest number of formalin treated fish (Figure 6). The results indicate that formalin is added in imported fish somewhere in the marketing chain after coming to Bangladesh. Several tests conducted by the Fish Inspection and Quality Control Services (FIQC) of Department of Fisheries (DoF) in Bangladesh in fish immediately after landing in Teknaf port found no incidence of formalin (DoF, 2009). At the time of landing in Bangladesh, the fishes were found individually packed with polythene in iced conditions. The importers sell these fishes to the different intermediaries. It is likely to assume that the fishes are dipped into formalin solution for a while by some fish traders before transporting to the different retail markets inside the country. 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) [9]. Though it is harmful and potential source of health hazard to human, some fish traders are engaged in treating fish with formalin. It was observed in a study conducted in Dhaka city (Hoque and Mohsin, 2009) [6] that almost 5% shops of total consumable fishes contain formalin treated fishes in the fish markets. They found this intensity varies market to market and species to species.

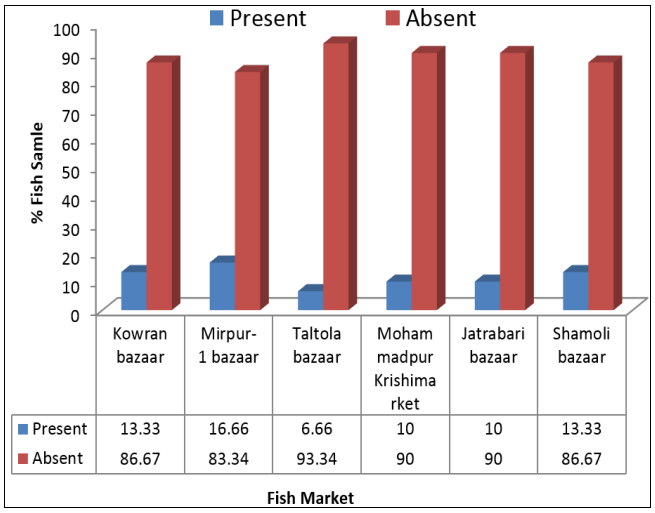

Fig 6: Comparative study of formalin availability in different location.

Research undertaken and published in 2009 based on a study of four fish markets in Dhaka City found formalin contamination in only 50 of 800 fish sampled, or 6.25%. The highest percentage was found in the Karwan Bazaar market. Large Rui and Katla, were the most commonly contaminated, although formalin use was also found in a number of other fish varieties including shrimp, Mrigal, and Kachki (Haque and Mohsin, 2009) [6]. A somewhat later 2010 study of two markets and three grocery stores in Dhaka found that an alarming 42% of 100 fish sampled had been treated with formalin. These included 70% of sampled Rui, 50% of Katla, 40% of Mrigal, 50% of Hilsa, and 0% of Sharputi. Contamination across the five sites ranged from 20-60% (Uddin *et al*., 2011) [15]. While percentages were not provided, a 2010study in Mymensingh also found evidence of formalin in imported Rui and Katla but not in local varieties of the same fish. The findings were consistent across the five Mymensingh markets studied (Yeasmin*et al*., 2010) [16]. A 2012 study of five markets in Sylhet found formalin in 26 of 150 sampled fish, or 17.3%. Again contamination occurred across the five markets, although it ranged from 6% to 26% of fish tested. Evidence of formalin was found in Rui, shrimp, and Katla, but not Mrigal or Hilsa (Rahman *et al*. 2012) [11]. These findings make clear that formalin is a common and even growing problem; however, they also suggest that it is perhaps not as pervasive as some media reports would suggest.

4. Conclusions and Recommendations

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. Average 11.66 percent fish sample were found formalin treated by laboratory analysis. All the formalin treated fish were imported species where Rui was dominant over other species. Cough, bronchitis and headache were the major health hazards being suffered by the consumers. 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.

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