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The awareness of food safety and hygiene among the dried fish processors at Chalan Beel area of Bangladesh

Md. Alam Bayezid[a*], Mohammad Manjurul Alam[a], Muhammad Afzal Hussain[a], Syeda Nusrat Jahan[a], Fawzia Adib Flowra[a]

[a] *Department of Fisheries, School of Agriculture, University of Rajshahi, Rajshahi, Bangladesh*

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ABSTRACT

The present study was conducted in five subdistrict (Singra, Atrai, Chatmohar, Vangura, and Tarash) under four districts of Chalan Beel area of Bangladesh from January 2015 to March 2016 to evaluate the status of awareness among dried fish processors with respect to hygiene and sanitation issues enrolling 60 processors who were subjected to the questionnaire interviews. Among the respondents, 49%, 20%, and 3% of the respondents belonged to the primary, secondary, and above SSC level, respectively, and others were illiterate. Most of the processors (65%) adopted fish drying as primary occupation. Monthly income of majority of the processors (55%) varied between 5001 and 10000 BDT. About 60% processors received training. Among the drying sites, 55% were lacking toilet facility and 62% processors were habituated to practice partial washing and dressing whereas 35% were not in practice. In addition, 32% and 28% of the respondents used Beel (deeper areas of floodplain similar to lake) and river water, respectively, while only 7% of respondents used tube well water and 68.3% were not used to washing hand with soap or ash. Moreover, though 65% of processors made knowledgeable response regarding harmful effect of insecticide application, however, in contrast to their perception, 51.7% of processors used insecticide. Only 21.7% of processors were likely to maintain government office linkage and 61.7% of respondents expressed positive attitude regarding cooperative formation. Such study has implications for evaluating status of awareness in terms of prevailing knowledge, attitude, and practices of dried fish processors.

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1. Introduction

Each year, millions of people worldwide suffer from foodborne diseases and illnesses resulting from consumption of contaminated food (1). In less developed countries, many people are poisoned because of the consumption of foods produced under unhygienic conditions, lack of hygiene education, contaminated waters, inappropriate food storage conditions, and pesticide residue (2). Contaminated and unhygienic food production is a major problem which now Bangladesh is badly suffering from due to poor health literacy and low level of awareness (3). In Bangladesh, contaminated dried fish treated with hazardous insecticides has gained consideration among consumer due to widespread media attention (4).

Among the fish products, dried fish (Locally named as *Shutki*) is the most popular food items in Bangladesh. It is a concentrated source of protein and mineral which serves a significant role to combat protein malnutrition (5). Chalan Beel (deeper areas of floodplain similar to lake) having vast water area, which contributes to substantial amount of freshwater dried fish production and located in Northwest Region of Bangladesh, is the largest Beel (In rainy season: 375 km^2 and in dry season: 52-78 km^2) of the country producing huge amount of freshwater fishes every year (6). In Bangladesh 18-20% fish from mostly low-cost marine, with a few freshwater fish are sun-dried (7). Traditional drying

* Corresponding author. Tel.: +88 01724667954
E-mail address: alambayezid@gmail.com

methods in tropical countries are likely to be contaminated by sand or dust and infested with fly larvae (8). According to "Fish and Fishery Products Official Controls Protocol" of Bangladesh, staffs handling fish products are to be in good health and need to observe adequate hygienic behavior and undergo training on health risks. In addition, fish processing equipment, containers and vessels along with potable water should be used to prevent contamination (9).

Coulter and Disney (10) found a 22% loss in dried fish in Bangladesh due to insect infestation. To avoid such insect infestation and microbial contamination commercial dry fish processors often apply several harmful insecticides in dried fish (11). These chemical control methods are usually effective, but there are serious health and environmental problems associated (12). The insecticides have immediate and long-term effects in human health (13).

With respect to dried fish, some studies (14,15,16,17,18,19,20,21) have been conducted focusing on fish drying techniques and biochemical quality, but study on safety and quality issues from food safety perspective with particular emphasis on awareness and behavior of dried fish processors is yet to be attempted. Therefore, the present study is intended to examine the status of awareness among the dried fish processors from different fish drying sites of Chalan Beel, which would help formulate recommendations and interventions in training and other awareness-building approaches that lead to developing hygienic behavior and healthy practices ensuring safe dried fisheries products.

2. Materials and methods

This was a survey study conducted in Chalan Beel area at Singra Upazila, Natore; Atrai, Naogaon; Chatmohar and Vangura, Pabna and Tarash Upazila, Sirajganj District of Bangladesh from January 2015 to March 2016 to evaluate the status of awareness among dried fish processors of the Chalan Beel. Data were collected on awareness of dried fish processors regarding safety and hygiene issues by holding focus group discussion and using pre-tested structured questionnaire. A total of 60 dried fish processors were selected from the study areas and were subject to interview. Structured questionnaire was pre-tested in field level and modified with necessary corrections which were finally administered to the respondents. The focus group discussion and questionnaire-based data were coded and analyzed using IBM SPSS Statistical package (version 20, IBM Corporation, Armonk, NY, USA) and presented as descriptive statistics percentage, means and chi-square test and all analyses were performed at the 5% significance level ($P < 0.050$).

3. Results

3.1. Socioeconomic characteristics

Among the 60 respondents enrolled into the study, 60% belonged in the age group of 46-60 years, and 65% had 11-20 years of fish drying experience. Educational status of majority of respondents was low, among them, 48.3% were in primary level, and 13.3% were illiterate. In terms of pattern of profession, 65% were found to receive fish drying as a primary occupation.

Average monthly income ranged in most cases from 5000 to 15000 BDT and monthly earning of 55% processors varied between 5001 and 10,000 BDT among the respondents 60% received only single training on safe dried fish production. Most of the processing sites (73%) did not have access to electricity, and 55% of the fish drying sites were found to be devoid of toilet facility (Table 1).

Table 1. Socioeconomic characteristics of dried fish processors

Parameters	n (%)
Age of processors	
20-30	1.7
31-45	38.3
46-60	60.0
Educational level	
Illiterate	13.3
Can sign	15.0
Primary	48.3
Secondary	20.0
Above SSC	3.3
Year of experience	
6-10	18.3
11-20	65.0
above 20	16.7
Pattern of occupation	
Primary occupation	65.0
Secondary occupation	35.0
Training	
Training received	60.0
Training not received	40.0
Electricity connection	
Preset	27.0
Absent	73.0
Toilet facility	
Pit/kacha	33.3
Sanitary	11.7
Absent	55.0

SSC: Secondary School Certificate

3.2. Safety and quality issues in dried fish processing

From the respondents, 62% processors occasionally practiced dressing activities including descaling, gutting, splitting lateral muscle, and washing of fish before drying which were accomplished usually in large and thick fishes such as Soal (*Channa striatus*), Boal (*Wallago attu*), Silver carp (*Hypophthalmichthys molitrix*), and Taki (*Channa punctatus*). Most of the processors were likely to dump dressing and other waste materials directly in Chalan Beel (36.7%), pond (16.7%), river (28.3%), and even in open places (18.35%). In many

cases, drying racks (Bana) were not adequately washed and cleaned on regular basis. Among them 15 % processors washed drying racks after end of each production cycle (Figure 1).

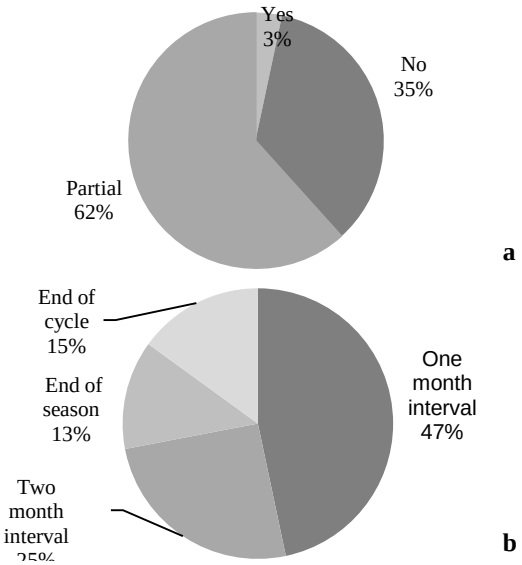

Figure 1. Dressing practices (a) washing of drying racks (Bana) (b)

In all the cases, fish were subject to preliminary treatment with salt before drying which varied from 5% to 15%. Majority of the processors (51.7%) used 8-10% salt. For temporary storage, 56.7% respondents used jut made gunny sack (locally called "*Jhail*") and many of them were found to store dried fish on mat spread on the earthen floor while some processors stored on slightly elevated bamboo made rack under the tent made of thin plastic sheet and bamboo splits until marketing (Figure 2).

3.3. Impact of training on awareness and food safety issues

Among the respondents, 32% were found to use Beel water, and in addition, river and pond water was used by 28% processors from each source while very few (7%) used tube well water. However, with respect to selection of water source, training had no significant impact (P > 0.050) (Table 2).

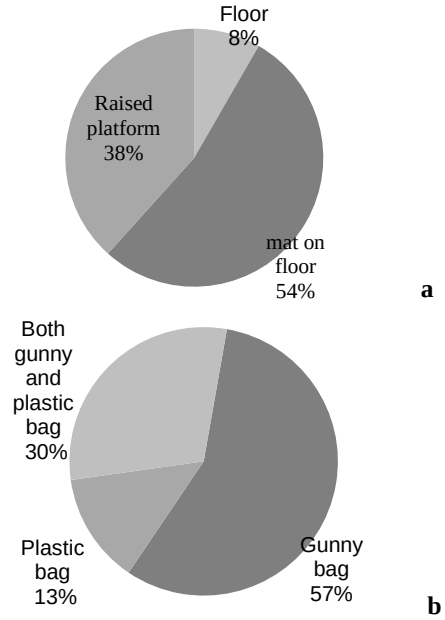

Figure 2. Temporary storage place (a) dried fish packaging bag (b)

Table 2. Bivariate distribution of the respondents in terms of training with different awareness variables

Variable	Participation in training		Total	χ^2_{cal} and p value
	Yes (%)	No (%)		
Water source				
Pond	10 (58.8)	7 (41.2)	17 (28.3)	χ^2_{cal} = 1.36
Beel	12 (63.2)	7 (36.8)	19 (31.7)	P = 0.850
River	10 (58.8)	7 (41.2)	17 (28.3)	
Tube well	3 (75.0)	1 (25.0)	4 (6.7)	
Tube well and pond	1 (33.3)	2 (66.6)	3 (5.0)	
Total	36 (60.0)	24 (40.0)	60 (100)	
Wash hand with ash or soap				
Yes	15 (78.9)	4 (21.1)	19 (31.7)	χ^2_{cal}= 4.15
No	21 (51.2)	20 (48.88)	41 (68.3)	P = 0.041
Total	36 (60.0)	24 (40.0)	60 (100)	
Know side effect of Pesticide				
Yes	28 (71.8)	11 (28.2)	39 (35)	χ^2_{cal}= 6.45
No	8 (38.1)	13 (61.9)	21 (65)	P = 0.011
Total	36 (60.0)	24 (40.0)	60 (100)	
Apply insecticides				
Yes	19 (61.3)	12 (38.7)	31 (51.7)	χ^2_{cal}= 0.44
No	17 (58.6)	12 (41.4)	29 (48.3)	P = 0.830
Total	36 (60.0)	24 (40.0)	60 (100)	
Government office linkage				
Yes	9 (69.2)	4 (30.8)	13 (21.7)	χ^2_{cal}= 0.59
No	27 (57.4)	20 (42.6)	47 (78.3)	P = 0.440
Total	36 (60.0)	24 (40.0)	60 (100)	
Interested to form cooperative				
Yes	25 (67.6)	12 (32.4)	37 (61.7)	χ^2_{cal}= 2.3
No	11 (47.8)	12 (52.2)	23 (38.3)	P = 0.130
Total	36 (60.0)	24 (40.0)	60 (100)	

Table 3. Commonly used insecticides in dried fish of Chalan Beel area

Name	Group name of insecticides	Amount of insecticide mixed with water (ml/l water)	Amount of fish treated with insecticide solution (Kg/l)
Sobicron 425 EC	Profenofos and cypermethrin	1.5	80-100
Sumithion 50 EC	Fenitrothion	2	100-120
Syperin 10 EC	Cypermethrin	1.5-2	100-140
Ricon 60 EC	Diazinon	2	100-120
Karate 2.5 EC	Lambda-cyhalothrin	1.5-2	80-120

In case of hygienic practices like hand washing, 68.3% dried fish processors were not habituated to washing hand with soap or ash before and after drying operation and also to maintaining appropriate degree of hygiene and sanitation. However, the effect of training appeared significant statistically ($P < 0.050$) in case of awareness with regard to habit of washing hands.

3.4. Use of insecticides and implications for legal and regulatory framework

Out of 60 processors, 65% were found to be knowledgeable on harmful effect of insecticide application. In consequence, with respect to creating knowledge regarding harmful effects of pesticides, impact of training turned out to be statistically significant ($P < 0.050$). However, findings revealed that training had no significant impact ($P > 0.050$) in terms of careless behavior regarding insecticide application (51.7%), which was an interesting contrast to their reported level of awareness. Different types of harmful agricultural insecticides are often used in dried fish, especially for large fish during consecutive rainy and foggy weather (Table 3). When asked question regarding legal steps against malpractice of insecticide application, surprisingly all the respondents made same answer that concerned regulatory body or authority had taken no monitoring and preventive measures to address this unethical practices.

Those respondents who were not involved in applying insecticides stated that they usually practice high dose of salt instead of insecticide during adverse weather to prevent fly infestation and bacterial spoilage. In case of communication with government office, 21.7% were found to maintain concerned government office linkage. Many of them (61.7%) expressed positive attitudes toward cooperative formation with other dried fish processors. However, training had no significant effect on attitude with respect to these responses ($P > 0.050$) (Table 2).

4. Discussion

As far as educational level is concerned, most of the dried fish processors of the present study belonged in primary level and many of them were illiterate. This result is comparable with Flowra et al. study (22) which reported that educational level of dried fish processors of Tarash, Sirajganj was very poor. In our study, monthly income of majority of the processors was low which was considerably depended on fluctuation of availability of raw fish in the Chalan Beel area. Other studies (22) stated almost similar findings in Kuakata and Tarash (15), respectively, with regard to monthly income. Awareness building training for dried fish processors of the studied area was quite insufficient, in fact, only single training program was organized for the first time in 2015 by a university-run research project, which covered only 60% processors of the area, and regrettably was the very first training since they had started fish drying business. Therefore, terming the prevailing training program inadequate, processors expressed their desire and urge for more follow-up training. Surprisingly, no such training was reported to have been arranged by concerned government department yet.

According to fishery product control protocol (9), adequate number of toilets are needed to be available connected to an effective drainage system, however, in reality this study indicated that majority of the fish drying sites did not have enough toilet facility, which is an obvious indication of noncompliance with sanitary and healthy practices and which ultimately could serve as source of fecal contamination which put processed dried products at risk of microbial hazards. Electricity access was not available in most of the fish drying yards as a result of being located in a place where no electricity pole was available within vicinity.

In our study, most of the drying sites did not have access to tubewell water or potable water for adequate washing of dressed fish and utensils and also for maintaining personal hygiene. As a result, despite having training, processors were likely to use Chalan Beel or river water which serves as potential source of pathogenic bacteria. According to fishery product control protocol (9), to ensure hygiene requirement compliance, using of adequate potable water is obligatory for fish processing activities. Okonko et al. study (23) showed that 80% of all illnesses are linked to use of water of poor microbiological quality. Another study (24) reported pond, river and Beel water may be potential source of contaminants due to indiscriminate deposition of human, animal excreta and other environmental

wastes into natural water, land and during the rainy season especially, as the fecal matter from various sources are washed from contaminated land into different water bodies. In present study awareness with respect to hand washing before and after fish drying activities was significantly influenced by training. One research (25) findings revealed that smoked dried fish were subject to repeated contamination from unwashed hands of processors and vendors. Another research (12) observed that lack awareness of the processors regarding hygienic practices as well as food safety and quality aspects contributed to production of poor quality and unsafe dried fish.

Our study reveals that for ensuring contamination-free products, many processors paid very little attention and were not significantly influenced by training in many aspects of hygienic practices like dressing of fish and waste management. Most of the drying sites were likely to dump dressing and other wastes directly into nearby open place or Beel water, which results in pollution in surrounding environment increasing risk of more blowfly infestation and microbial contamination. Nowsad study (26) reported that dried fish are not adequately washed and dressed before drying and this problem is very much associated with the small fish in which adhered blood, slime, and juice from the rotten abdomen contaminate the entire lot and thus deteriorate the quality.

It was commonly noticed that fish drying racks were kept spread outside where dogs, cats, and birds could graze which may pose unhealthy and risky impacts. Majority of the processors did not practice proper washing of drying racks after each production cycle which was likely to result in contamination, and this could be attributed to inadequate and irregular washing. In a study (25) it was revealed that in Nigeria drying materials and facilities used for processing were not always properly cleaned and washed immediately after use, and this resulted in accidental contamination and also harbored pathogenic organisms which were threat to food safety.

In our study, with respect to making perception regarding harmful effects of insecticides, training had a significant impact. Interestingly, despite giving knowledgeable response with regard to hazardous impact of insecticides, many of the processors used insecticides on regardless violating the law from sheer ignorance, which could be attributed to the lack of follow-up awareness training, regular monitoring and inadequate enforcement of legal measures by concerned responsible authority. Present findings were supported by another study (14) in terms of using insecticides at Singra Upazila of Chalan Beel. Besides, as per provision of "Fish and Fish Products (Inspection and Quality Control) Rules 1997" no person will carry out any fish processing or curing activities without having license from concerned authority; and dichloro-diphenyl-trichloroethane or other harmful insecticides are completely prohibited except few specific bio-degradable insecticides with permitted dose approved by competent authority (27). Anma study (3) reported in case of laws with regard to food safety in Bangladesh that inadequate enforcement of laws due to unnecessary bureaucracy and insufficiencies of penalties have ultimately made it ineffective.

Some processors were found to apply salt varying in relation to quality of raw fish and weather condition to prevent insect infestation. In cloudy and rainy or foggy days fish were subject to salt treatment with a higher dose to harden the fish, reduce contamination and remove water which ensures protection against spoilage and insect infestation. Nowsad study (26) found that in cloudy and rainy days fish are required to be treated with 15-30% of salt and extra salt adhered to the body surface need to be removed before drying through adequate washing so that dried fish remain less salty, and salt concentration does not exceed 3-7% science consumer usually prefer dried fish that contains little or no salt. However, fish were likely to get contaminated due to use of low-cost non-brand open salt having impurities which could serve as a source of bacterial contamination. In other studies, similar results were observed (16,22).

Present study observed that in majority of the drying sites, fish remain exposed in unsanitary way on mat spread on the ground or on bamboo made rack which makes it susceptible to moisture absorption and contamination ultimately resulting in quality deterioration. In a study (28) on dried fish processors of Cox's Bazar District showed that when the fish remain uncovered and without adequate packaging, beetles and mites infestation of the finished products is likely to take place.

According to the perception of respondents, our study found that cooperative could help considerably reduce illegal influence of commission agents (Arotder) and get fair price of the products. Therefore, to get rid of prevailing deprivation and unethical dominance from wholesaler syndicate, majority of the processors expressed willingness to form cooperative society. According to a study (26), small entrepreneur of dried fish processors formed a cooperative society named "Nazirartek Fish Traders Multipurpose Cooperative Society" which appeared to be effective in establishing the rights of fish drying activities and business. Our studied respondents were confined to

those who conducted their fish drying activities adjacent to different areas of Chalan Beel, Bangladesh.

5. Conclusion

From the above study, it is apparent that though most of the dried fish processors responded to be aware of the health hazards resulted from harmful pesticides, poor hygienic environment, and unclean utensils as well as washing water of below safety standard, they are, nevertheless, producing unhealthy and unsafe dried fish without considering the food safety and quality implications of these malpractices. Given the perspectives of the prevailing unhealthy practices like use of insecticides and drying in unhygienic environment, question arises as to whether the present persuasive measures such as awareness training, motivational campaign have been conducted adequately in effective manner. Therefore, processors need to undergo further training on awareness with certain interval, so that learnt information regarding safe dried fish production is turned into attitudes and behaviors and also on improved scientific method of safe dried fish production. Moreover, besides raising awareness more effectively, concerned quality control and regulatory agencies have to initiate regular monitoring of dried fish processing and marketing activities to substantially curb deliberative abuse of harmful insecticides. Finally, collective measures such as adequate national policy, effective coordination among the agencies concerned with food safety, introducing registration system along with certification for fisheries products, and proper enforcement of laws could be effective to address the food safety issues prevailing in this sector.

Conflict of Interests

Authors have no conflict of interest.

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