

STUDIES ON NITROFURAN CONTAMINATION IN EXPORTABLE SHRIMP AND PRAWN PRODUCTS

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ABSTRACT

For the last few years, several consignments of frozen prawn and shrimp from Bangladesh have been rejected by the EU and USA due to presence of nitrofurans. We have investigated the source of nitrofurans in shrimp and prawn through participatory stakeholder based approach. Survey in greater Mymensingh region revealed that most of the hatchery operators and prawn farmers did not know about the devastating effect of nitrofurans on prawn while survey in Cox's Bazar and Khulna revealed that most of the hatchery operators knew about the nitrofurans but they kept mum on nitrofurans related issues. A series of antibiotics sold in local veterinary drug shops of Cox's Bazar and Khulna were found to be used in shrimp hatcheries. While conducting stakeholder based dialogue in Khulna and Cox's Bazar, hatchery operators were directly blamed by shrimp/prawn farmers, depot holders and processors for using nitrofurans. Many hatchery technicians mentioned that they used nitrofurans in the hatcheries 5-6 years back, much before than it was declared banned on shrimp products, but at present they were not using it. While asking about the unlabelled drugs using in their hatcheries, they did not respond but mentioned the efficacy of nitrofurans in the survival of shrimp/prawn PL and promotion of their growth. From the participatory stakeholder based study it was understood that both the prawn/shrimp hatchery and poultry feed/fish feed used as shrimp/prawn feed in grow out ponds might be the possible sources of contamination of nitrofurans in exportable shrimp/prawn products.

Key words : Nitrofurans, Shrimp/prawn products, Hatchery, Shrimp/prawn feed

INTRODUCTION

The frozen food industries have become the second largest export sector which registered a total export earning of \$ 408.87 million in the July-March period of the fiscal year 2007-08 compared to that of \$ 3.17 million in 1972-73. Nitrofurans contamination is appearing as a serious blow to the steady growth of this sector. Due to carcinogenic effect of nitrofurans, it has been declared completely unfit (zero tolerance limit) for human consumption (Finzi *et al.*, 2005). Fast growing frozen shrimp/prawn export sector is now at serious stake due to such zero tolerance policy of the EU and hard lining of the FDA on presence of nitrofurans (DoF, 2006).

Nitrofurans are frequently employed in the poultry and fish production for their excellent antibacterial, pharmacokinetic and growth promoting properties (Hartig *et al.*, 2005). Due to a multi-stakeholder involvement in the chain of production, transportation, marketing and processing of fish and shrimp in Bangladesh, it seems increasingly difficult to identify the sources of antibiotic contamination. Such contamination in fish foods may occur from the water supply, feed, hatchery produced seed, etc. and by the primary producers and other traders in the handling and distribution chain and finally by the processors and packers. If such unethical contamination continued, rapidly expanding fisheries sector will be doomed, millions of people will be unemployed and finally, the country's economy will be devastated. Considering such backdrop the study was conducted to investigate the source of nitrofurans in shrimp and prawn through participatory stakeholder based approach. It is the first investigation of its kind in Bangladesh.

MATERIALS AND METHODS

Study area

To conduct the study three major locations were selected. These were- Mymensingh area for hatchery and husbandry of exportable prawn; Khulna, Satkhira and Bagerhat area for farming and processing of shrimp/prawn and Chittagong and Cox's Bazar zone for hatchery operation, aquaculture and processing of shrimp.

Collection of secondary information

All sorts of secondary information concerning use of nitrofurans in shrimp and prawn were collected from the print and electronic domains, books, journals, periodicals, reports, news papers, internet browsing, institutions/persons, GO/NGO bodies and from different stakeholders of this sector.

Review of the information

Collected information was reviewed very critically. Several expert consultations were made to obtain a detailed overview of both legal and technical aspects of antibiotic use in shrimp and prawn.

Collection of primary information

Two methods were employed: questionnaire survey and stakeholder-based dialogue. Questionnaire surveys were conducted through several semi structured questionnaire formats. The collected data were cross-checked, verified and field tested through rapid rural appraisals (RRAs), group discussions, brain storming and personal contacts.

Taking the nitrofurans issue as a serious concern, a series of dialogue in the form of workshop, RRA, focused group discussion (FGD) and brain storming were carried out with the stakeholders in Khulna, Chittagong, Cox's Bazar and Mymensingh. Firstly, several distinctive RRAs were conducted on the shrimp farmers, hatchery operators and

traders in Khulna and Cox's Bazar. Same was done with the prawn farmers and hatchery operators of five upazilas of Mymensingh - Fulpur, Gouripur, Sadar, Trishal and Valuka. Government machinery like district and upazila fisheries administration, upazila level fish farm managers and Deputy Directors of Fish Inspection & Quality Control (FIQC) wing of the Department of Fisheries (DoF) in Chittagong and Khulna were involved in such dialogues to cross-cut the argument of different stakeholders in the value chain. Stakeholder-based workshops on nitrofurans use and its impact on shrimp industry was organized in Khulna and Cox's Bazar with different stakeholders of the value chain as participants. Main stakeholders were shrimp/prawn farmers, hatchery owners, hatchery operators/technicians, PL traders, shrimp/prawn transporters, depot holders, feed processors, processing factory owners, NGOs, research institutes, FIQC officials and academia personnel. Valuable information related to the contamination of shrimp/prawn by nitrofurans derivatives have come out from the workshops. Different stakeholders were allowed to discuss on common specific items separately. The team leader of each stakeholder group presented respective group outputs. The participants were given full freedom to discuss the current situations of shrimp/prawn industry in general and nitrofurans contamination in particular. Presentations provoked the participants to uncork the mouth and actively take part in the discussion. Cross-discussion, justifications of issues, cross-cutting answers, arguments and counter-arguments, etc. laid a genuine platform for finding out the fact behind the use of nitrofurans in prawn and shrimp. These stakeholder-based workshops made strong basis for contributing to the policy deriving workshops organized by the Department of Fisheries and the Ministry of Fisheries and Livestock in Dhaka, where all policy making, regulatory and implementing agencies were participated.

RESULTS AND DISCUSSION

Three questionnaire surveys were conducted on shrimp/prawn farmers and hatchery operators of Mymensingh, Khulna and Cox's Bazar regions.

Survey in Mymensingh area revealed that most often the operators and farmers were reluctant to give authentic information. Most of them did not know the devastating effects of nitrofurans metabolites in prawn products. Almost all hatchery owners did not hear about nitrofurans before. However, they had heard about chloramphenicol. They never used nitrofurans and chloramphenicol in either prawn post larvae (PL) production in hatcheries or culture in grow-out ponds. Among the antibiotics, they used only renamycin and oxy-tetracycline (OTC) for treatment of prawn disease (Table 1). In the ponds, farmers used formalin, calcium hydroxide, zeolite, methyl blue and cee-vit (Vitamin C) for treatment of disease. Ex-ADB Hatchery Manager, now Senior Upazila Fisheries Officer of Gouripur, Mymensingh told that labeled nitrofurans drugs had been frequently used in shrimp hatcheries in Cox's Bazar 6-8 years back. After imposing ban on it, foreign technicians removed the nitrofurans and instead of these, they had started using huge unlabelled antibiotics in the hatcheries. Due to effective bactericidal and

growth promoting characteristics, it was assumed that these unlabelled ones were no doubt but any banned drugs.

Table 1. Veterinary drugs used in Mymensingh area for freshwater prawn PL production

Name of the hatchery	Supplementary feed used		Disease out break	Antibiotic used		Growth promoter	
	Name	Rate		Name	Dose	Name	Dose
Kashigonj Golda Hatchery (Fulpur)	Artemia and custard (Egg, Milk, Vit. B, C, Mineral)	2/3/4 Times depends on condition	White spot, louse, zoothamnia	Formalin OTC, B50	1.25g/Ton	Cyclopis	14/Ton
Grehanggon Hatchery (Fulpur)	Artemia and custard (Egg, Milk, Flavour)	2/3/4 times depends on condition	White spot	Renamycin	2 g/Ton	Cyclopis	10/Ton
Grehanggon Hatchery (Fulpur)	Artemia and custard (Egg, Milk, Flavour)	2/3/4 times depends on condition	Not occurred	Not used	Not used	Not used	Not used
Zalak Fresh water Golda Hatchery (Gouripur)	Artemia and custard (Egg, Milk, vit. B, C cod oil)	2/3/4 times depends on condition	Parasite, spot, bacterial disease	OTC	1.2 g/Ton	Cyclopis	10-12 /Ton
Grehanggon Hatchery (Trishal)	Artemia and custard (Egg, Milk, Flavour)	2/3/4 times depends on condition	Rapid death with out showing any symptom	Renamycin	1-2g/Ton	Not used	Not used
Agro-3 (Trishal)	Artemia and custard (Egg, Milk, Vit. B, C Mineral, cod oil)	2/3/4 times depends on condition	Parasite, spot	OTC	1.5g/Ton	Not used	Not used
BFRI Mymensingh	Artemia and custard (Egg, Milk, Flavour)	2/3/4 times depends on condition	Bacterial disease (Rapid death)	Renamycin	1 pellet/ 300 litre	Not used	Not used

Questionnaire survey conducted in Cox's Bazar area could not bring adequate information to draw out any conclusive comments on PL production and culture of marine shrimp. It was understood that most of the hatchery operators knew about the nitrofurantoin drugs but they kept mum, while discussed, on nitrofurantoin related issues. Many antibiotics were mentioned to be used like OTC, chloramphenicol, atropin sulphate, finthyd, nolenon, carbafuran, etc. (Table 2). Many unlabelled antibiotics were found to be used in the hatcheries. Chloramphenicol, although well-known as a banned antibiotic for use in shrimp, was reported to be used in the hatcheries of Cox's Bazar. Most of the answers of the hatchery operators were negative. Sometimes they opened mouth for a particular drug as being used in the hatchery but soon they denied or reluctant to tell the exact dose using. Some of the growth promoter type drugs mentioned was epicin, probiotics, nitrofurantoin, etc.

Questionnaire survey in Khulna area revealed that farms in southern Khulna region had been using Indian PL, as being sold in the black market. Local drug houses were found to sell chloramphenicol, OTC, atropin sulphate, finthyd, nolenon, carbafulan and many other unlabeled and undisclosed antibiotics (Table 2). Hatcheries were reported to use chloramphenicol (Bacteriocide-CL) and OTC (Bacteriocide-OTC) for treatment of disease. Hatchery technicians were reported to use many unknown antibiotics for better production and survival of PL. Like-wise Cox’s Bazar, hatchery technicians of Khulna region also kept mum on nitrofuran drugs, some one disclosed the information on tremendous PL survival and growth promoting charisma of nitrofuran. Many hatchery technicians told that they used nitrofuran drugs in the hatcheries 5-6 years back, well before it was declared ban on shrimp products, but now they were not using it. While asking about any unlabelled drugs using in their hatcheries, they became furious and did not answer.

Table 2. Veterinary drugs used in Cox’s Bazar and Khulna for PL production of marine shrimp

Location	Supplementary feed used		Disease out break	Antibiotic using		Growth promoter	
	Name	Rate		Name	Dose	Name	Dose
Cox’s Bazar Sadar	Starter feed, plankton, minerals, etc	2/3/4 times depends on condition	Luminous bacteria (LB) white spot	OTC, chloramphenicol, atropin sulphate, finthyd, nolenon, carbafulan , nitrofuran	Unknown as reluctant to disclose	Epicin, probiotics, nitrofuran drugs	Not known
Ukhiya	Starter feed, plankton, minerals, etc	2/3/4 times depends on condition	LB, white spot	Renamycin, OTC, chloramphenicol, finthyd, nolenon, carbafulan, nitrofuran	same	Unknown nitrofuran drugs	Not known
Khulna	Starter feed, plankton, minerals, etc	2/3/4 times depends on condition	LB, white spot	OTC, chloramphenicol, atropin sulphate, finthyd, nolenon, carbafulan, nitrofurazon	same	Unknown nitrofuran drugs	Not known
Govt hatcheries (Cox’s Bazar, Khulna)	Starter feed, plankton, minerals, etc	2/3/4 times depends on condition	LB, white spot	OTC	1.2 g / ton		Unknown

Stakeholder-based dialogue in Khulna

In the stakeholder-based dialogue, the stakeholder groups discussed the issues within the group members and wrote their unanimous comments on the flip chart. Sufficient time was allocated for the group discussions. The group leaders presented group activity results (Table 3).

Hatchery operators were blamed directly by the shrimp farmers but indirectly by the shrimp processors and other groups. Again shrimp/prawn farmers were blamed by the hatchery operators and others. Hatchery owners tried to defend them mentioning that they did not know about nitrofurantoin. But during questionnaire interview they told that they used such nitrofurantoin drugs 5-6 years back when these were not banned. During question-answer session they agreed on such abuse and requested for some safe drugs as effective replacement of nitrofurantoin. When asked about the unlabelled antibiotics found to be used in hatcheries, they said that unlabelled antibiotics were safe antibiotics but they kept those drugs confidential in order to protect the business monopoly. Hatchery operators deliberately argued for effective alternatives of nitrofurantoin in hatcheries. All these week arguments raised the index finger on to them that they might be one of the potential source to contaminating shrimp with nitrofurantoin in the hatcheries during PL production. Other probable sources of contamination in shrimp as came out during the discussion were huge nitrofurantoin drugs in poultry feed used as shrimp/prawn feed, the contaminants in natural water and soil, poultry litter, snail meat and agricultural chemicals.

Stakeholder-based dialogue in Cox's Bazar

Similar stakeholder based dialogue was conducted in Cox's Bazar. Here, hatchery team leader along with the team members showed strong difference as saying that if anybody blamed them for nitrofurantoin or any decision went against them, they would boycott the workshop. They tried to put forward many theoretical aspects of nitrofurantoin as displaying them that they knew about nitrofurantoin much better than others. At first, they told that they did not know about nitrofurantoin, neither its beneficial effects, nor its harmful characteristics. But soon they told that they used this drug 5-6 years back when it was not banned. One of the team members quoted that they had taken training on quality control of shrimp products along with nitrofurantoin type banned veterinary drug related issues, conducted by the FIQC, 4-5 years back. Such statement of one member was soon rejected by the team leader and other members as saying that they did not participate in any training of the FIQC on quality control or nitrofurantoin. The team themselves quarreled each other for some times on this issue. These proved some of them to be more biased on nitrofurantoin drugs. Irrelevant arguments and contradictory statements made by the hatchery technicians and hatchery consultants developed a strong web of doubt passing over the house that the hatchery technicians might use banned drugs in hatcheries. Hatchery technicians again pointed out that being an antibiotic, it could not be possible to detect nitrofurantoin derivatives in muscles as it would disappear within 2 weeks. So, what had been blaming to them on nitrofurantoin issue had no legal basis. But the fact is that nitrofurantoin derivatives readily disappear in the muscles within a few hours to few days due to tissue-bound formation of different metabolites, which are detectable by advanced liquid chromatography tandem mass spectrophotometry (LC-MS-MS) system (Hartig *et al.*, 2005). Through these advanced technique nitrofurantoin metabolites could be detected in the muscles after long time of administration, even after 6-8 months (Hartig *et al.*, 2005). However, at one stage of the dialogue, they became very angry upon as the whole house

unanimously opined as being realized that the hatchery technicians were deliberately using many banned antibiotics in the hatcheries during PL production (Table 4).

Table 3. Findings of group discussion in stakeholder-based dialogue in Khulna

Stakeholder	Form of chemicals in use	Probable source of nitrofurantoin	Measures required to stop use
Shrimp Farmers	- We do not use any antibiotics either as feed or medicine - only use Vit. C - use CP Aqua Feed - use probiotics for disease control	PL from hatchery Natural feed Various poultry feed Pesticides from crop field	Hatchery shouldn't use any antibiotics; Awareness raising campaign, organizing meeting, workshop, etc. are necessary.
Shrimp Processors	Use as antibiotic in hatchery; Use growth promoter in rearing and culture.	Hatchery operators are using; Shrimp farmers are using these drugs; PL of other countries may carry drugs.	Citable penalty for abusers; Immediate establishment of detection lab; Strong regulations and their application required.
Hatchery Operators	We do not use nitrofurantoin and chloramphenicol; - use OTC only	Farmer use as poultry and shrimp feed; - as poultry litter Indian PL	Alternative of nitrofurantoin to be introduced immediately for the hatchery; Central detecting lab to be set
Depot Holder:	We do not use any antibiotics or chemical	Poultry and shrimp feed Farmer use as growth promoter	Screening of feed Stop importing poultry feed Awareness development
NGOs	Both as medicine & feed	Hatchery PL Non-deliberate use by farmers	Strict monitoring in hatcheries, Screening feed & feed ingredients
Feed Processors	We do not use any antibiotics or chemicals in CP Feed; CP Feed is free from any antibiotics; Certified by BCSIR	Natural contamination;	Antibiotic detecting lab to be established in the country; Nitrofurantoin-free high quality feed for prawn/ shrimp should used.
PL Traders	We do not use any antibiotics or chemicals	Hatcheries PL are weak and mortality is high; So chemicals and illegal antibiotics are used to increase survival rate.	Strict monitoring in hatcheries; Strict regulation on banned chemicals

Shrimp farmers and mother shrimp collectors directly blamed the hatcheries for using such illegal drugs. Other stakeholders like research institute, feed processors, depot holders, and shrimp processors indirectly blamed the hatcheries for bringing nitrofurantoin contamination in shrimp. Depot holders and others mentioned that feed would be one of the major source of contamination. NGOs told that although now unknown to them but definitely some of the present stakeholders might have been using such illegal antibiotics in hatcheries or farms. For the sake of the nation, they added, "we should have moral courage to confess the blame for not to use these banned items further."

Table 4. Findings of group discussion in stakeholder-based dialogue in Cox's Bazar

Different stakeholder	Form of chemicals in use	Probable source of nitrofurantoin	Measures required to stop use
Shrimp Farmers	Unknown to us May be as antibiotic	We do not use in pond or ghers; Shrimp hatcheries are using nitrofurantoin during PL production	Government should take legal action against use of nitrofurantoin
Hatchery Operators	We do not know about nitrofurantoin. We do not know the harmful/beneficial effect of it	No body is using nitrofurantoin in Bangladesh. First, detect it by appropriate instrument, then blame any body	Concerned institute should take the responsibility. Government should collect different field information. Research required for alternative safe antibiotics for hatchery use
Depot Holder	May be as antibiotic. For good health and rapid growth	Many stakeholders like hatcheries, farmers, feed processors might be using but there is no proof	All of us have to aware about the use of nitrofurantoin
NGOs	As antibiotic. As growth enhancer.	Exactly not known, but definitely several stakeholders who are also present in this workshop are using	Create awareness. Identify source and take strong punitive action
Fry Traders	As chemical fertilizer	Unknown to us	Problems, whatever may be strong, should be addressed collectively; It should be addressed nationally with strong regulations
Feed Processors	As antibiotics to cure disease	In shrimp/prawn hatcheries. In shrimp farms/ponds for disease control	Improved nutritional feed is required for healthy growth
Shrimp Processors	As antibio. As Antibiotic. As growth promoter	Somebody must be using, otherwise it would not have been detected repeatedly and consignment rejected regularly	Awareness creation & campaign; LC-MS-MS machine should be installed, DoF training program for FIQC people; Advanced research required on banned drug abuse

CONCLUSION

Both survey and stakeholder-based dialogues revealed that most of the stakeholders did not know about nitrofurantoin or other illegal drugs before. Many stakeholders blamed that nitrofurantoin type illegal drugs have still been used in the shrimp hatcheries and ponds for disease control and rapid growth. But the hatchery owners did not confess the blame. A strong doubt was raised against shrimp/prawn feed producers/suppliers, local or imported, which were supposed to be contaminated with illegal growth enhancing drugs. Feed processors/distributors also did not confess such blames. In such ambiguity, direct detection of nitrofurantoin metabolites in representative samples of shrimp/prawn hatchery PL, feed, products, water and soil samples through advanced technologies are required.

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